



APPLICATIONS COMPENDIUM

For the Food and Beverage Industry

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KROHNE

Food & Beverage

■ PREFACE

Dear reader,

This compendium comprises a selection of sample applications, which demonstrate how KROHNE has solved these industry-specific measurements to the satisfaction of our customers.

Whether it is standard or demanding applications with advanced requirements, our knowledge and experience of our customer's processes is key to addressing these challenges. Using this expertise, allows us to provide the appropriate measuring device, or if required by the application – to engineer complex measuring solutions.

We hope you will enjoy browsing through our various examples on the measurement of flow, level, temperature, pressure as well as process analysis.

If you require any further information on any of these applications, or if you have a challenge that we can solve for you, please don't hesitate to contact us: application@krohne.com

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APPLICATION REPORT Food & Beverage

Granulated sugar level measurement

- Storage of sugar of various grain sizes in concrete silos
- Non-contact radar measurement of medium that forms dust
- Automated inventory management of sugar supplies

1. Background

The Pfeifer & Langen Group is one of the largest sugar producers in Germany. In addition to several sugar plants, this long-established company also has plant locations for storage and logistics, one of which is located in Grevenbroich in the Lower Rhine region. Here, granulated sugar from the sugar factories is stored in four concrete silos. The silos are 30-40 m / 99-131 ft high and 20-30 m / 65-99 ft in diameter.

2. Measurement requirements

To match the supply of sugar to its production and make the filling process as efficient as possible, Pfeifer & Langen relies on level monitoring. In the past, a plumb line has been used to check the level manually. This method is extremely time-consuming as it required a company employee to regularly climb onto the intermediate floor of the silo and check the level at different spots through manholes. In addition, opening the silo presented the risk of an accident and of the product coming into contact with unwanted substances. In an effort to automate level measurement, Pfeifer & Langen were looking for a permanently installed measuring solution.

Due to the medium and the size of the silos, non-contact measurement was preferred. When selecting the measuring principle, the prevailing conditions in the silo had to be taken into account. This included the weakly reflective product surface of the sugar (ϵ_r -value: 1.8) as well as the formation of a variety of angles of repose in the silos. Depending on the grain size, dust can build up inside the silos. Under certain circumstances it could be several minutes following the filling process before the sugar compacts and settles. For this reason, ultrasonic measurement was eliminated early on as a viable solution.

3. KROHNE solution

The customer decided on the OPTIWAVE 6300 C non-contact radar level transmitter. Boasting a 24...26 GHz FMCW radar, the measuring device is designed for use in extremely dusty atmospheres. It features a patented, elliptical drop antenna that does not clog up, even in the presence of extremely adhesive media such as sticky sugar dust. Due to the measuring height and the low dielectric constant of the medium, in this application the large drop antenna (DN 150) made of polypropylene (PP) was selected. It was installed using a G1 ½ process connection. The devices were installed in the existing manholes in the intermediate floors of the silos.

The shape of the OPTIWAVE 6300 antenna concentrates the radar beam which helps to achieve the measuring range required for this application.. The measuring signal (4...20 mA) of the OPTIWAVE 6300 is transmitted to a control unit and the level is displayed in the control system.



Installation of the OPTIWAVE 6300 C

4. Customer benefits

Pfeifer & Langen benefit from continuous level measurement and can now reliably monitor the amount of sugar available in the silos, even when dust has built up. All information is automatically made available in the inventory management system. This prevents a lack of supply, any resulting disruption in production and overfilling of the silos.

As it is no longer necessary to manually check the level, the customer saves time and human resources. In addition, the OPTIWAVE 6300 incurs no further operating costs. While a crust of dust builds up on the antennas of other measuring devices and must then be removed manually or with the help of a purging system, the drop antenna of the OPTIWAVE 6300 is maintenance-free. As a result, Pfeifer & Langen did not have to install a compressed air line for purging, which saved energy costs, for example. And, as the silos no longer have to be opened, the integrity of the granulated sugar is guaranteed.

The customer is extremely satisfied with the measurement in the concrete silos and is currently looking into further use of the OPTIWAVE 6300 in smaller silos on site.

5. Product used

OPTIWAVE 6300 C

- 2-wire FMCW radar level transmitter for non-contact measurement of distance, level, volume and mass of solids
- PP or PTFE drop antenna prevents product build-up in dusty environments
- Specific installation assistant for accurate measurement with moving surfaces
- Measuring range up to 80 m / 260 ft



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APPLICATION NOTE Food & Beverage

Measuring layer thickness in a centrifuge

- Continuous measurement of layer thickness when filling centrifuge
- Controlling the layer thickness during the spin process
- Automated filling process

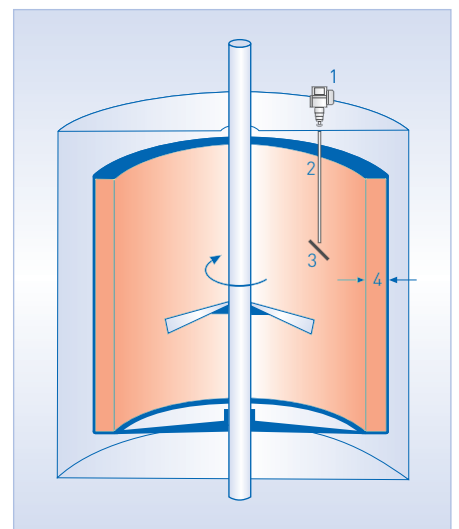
1. Background

A sugar producer fills a centrifuge with hot molasses sugar to press the moisture out of the molasses at high speed. The thickness of the layer of molasses on the wall of the centrifuge is reduced in the process. The layer thickness is thus a measurement of the moisture content of the layer of molasses.

2. Measurement requirements

The centrifuge is the shape of an upright barrel with a diameter of approx. 1.5 m / 5 ft. The filling process only lasts 5-10 seconds. The layer thickness on the wall of the centrifuge is to be continuously measured during this time so that the filling process can take place completely automatically. The measuring device can only be installed from above but must measure at a 90° angle. This is done using a 45° mirror which is attached to the end of a 700 mm / 2.30 ft waveguide and reroutes the radar waves. There is 150 mm / 0.5 ft between the molasses layer and the waveguide.

- 1 Measuring device
- 2 Waveguide
- 3 45° tilted mirror
- 4 Layer thickness of molasses



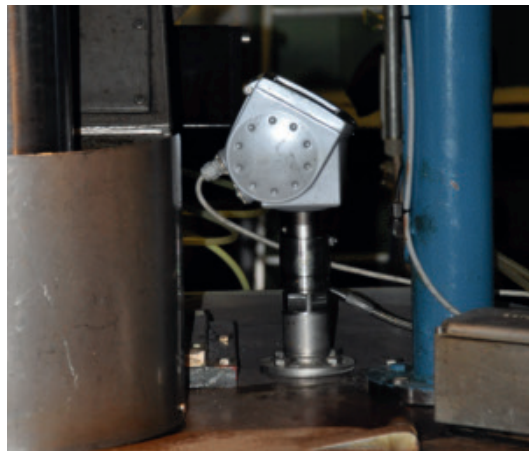
Centrifuge in detail

3. KROHNE solution

For this type of application, KROHNE supplied 4 OPTIWAVE 7300 C radar level measuring devices with DN 50 / 2" horn antennas and G 1½" connection. The existing constructions were used for mounting.

Thanks to FMCW radar technology, the OPTIWAVE level meters measure over a very wide dynamic range. That is why neither the minimally reflective surface of the molasses layer nor the high speed of the centrifuge when filling and during the spinning process affect the measurement of the layer thickness.

Following each spin cycle, all parts that come into contact with the molasses sugar are automatically cleaned with water to avoid any caking.



Installed OPTIWAVE 7300 C

4. Customer benefits

The customer is now in a position to completely monitor and automate the entire process of extracting the moisture from the molasses sugar. At any time, both while filling the centrifuge and during the spin cycle, the layer thickness on the wall of the centrifuge can be measured and the production process can be controlled accordingly, saving both time and money.



Waveguide with 45° tilted mirror

5. Product used

OPTIWAVE 7300 C

- Precise measurement in harsh conditions – even in tanks with agitated surfaces, foam or internal objects
- Product temperature up to 200 °C / 390 °F and operating pressure up to 40 bar / 580 psi
- For measuring ranges up to 80 m / 262 ft
- PACTware and DTMs are part of the standard scope of delivery
- Standard measurement error $\leq \pm 3 \text{ mm} / \pm 0.12''$
- 2-wire connection technology, minimal wiring expense
- Maintenance-free



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APPLICATION NOTE Food & Beverage

Measurement of Brix and mass flow in sugar production

- Determining the weight and sugar concentration in sugar cane juice
- Measuring without pressure drop or blockage of the measuring tube
- Cost-effective alternative to weighbridges and laboratory analysis

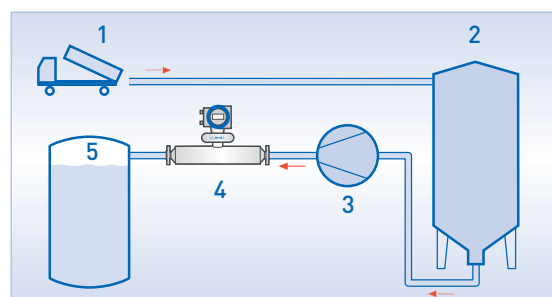
1. Background

A sugar manufacturer produces sugar from sugar cane juice. After harvesting, the sugar cane is crushed in presses to obtain the sugar cane juice. This juice is then weighed before it is made ready for further processing. In the past, measuring the weight of juice was done by large weighbridges (truck scales), which was inaccurate and cumbersome. To determine the BRIX value (sugar concentration), juice samples had to be collected and analyzed in the laboratory, which was very time consuming.

2. Measurement requirements

These methods resulted in significant investment and operating costs. The Brix values were also often late. Since Excise Duty is paid on the actual juice and not on the final product, eliminating uncertainties regarding the sugar concentration was important for the sugar producer. A decision was therefore reached to use a flowmeter to continuously determine the weight of the cane juice and the Brix values without delay. The meter was required to measure without risk of blockage and without requiring any maintenance.

Product:	Sugar cane juice
Mass flow rate:	250...350 t/h
Pressure:	5...8 bar / 73...116 psi
Density:	1060 kg/m ³ / 66 lb/ft ³
Viscosity:	10 cP•s
Operating temperature:	40 °C / 104 °F



1 Delivery of the sugar cane; 2 Sugar cane press; 3 Stop valve; 4 BRIX and mass flow measurement; 5 Storage tanks



3. KROHNE solution

KROHNE supplied the Coriolis mass flowmeter OPTIMASS 7300 C. The meter was installed between the sugar cane press and the storage tanks. It measures the mass flow of the sugar cane juice as well as the sugar concentration (the Brix value) by way of integrated density measurement. The single straight tube design makes the OPTIMASS 7300 the meter of choice for measuring viscous liquids such as sugar without the risk of blockages or pressure loss.



The OPTIMASS 7300 C with integrated concentration measurement

4. Customer benefits

The OPTIMASS 73000 has enabled the sugar producer to reduce investment and operating costs in sugar processing significantly through the elimination of expensive weighbridge systems that require extensive maintenance. The Brix values can now be determined on-site and to the extent that the customer can almost entirely refrain from labor-intensive and costly laboratory analysis. The Brix values are provided to production immediately. Thus, the customer stands to gain from all the viable information to accurately determine the total sugar production of the plant resulting in more profit and savings in Excise Duty.

5. Product used

OPTIMASS 7300 C

- Coriolis mass flowmeter for the accurate measurement of mass and volume flow, density, temperature, concentration and liquids with solid content
- Single straight measuring tube without constrictions
- Choice of 4 different measuring tube materials
- Typical burst pressure of the outer housing above 100 bar
- Self draining and easy cleaning irrespective of process influences and installation
- Precision and excellent zero stability
- Low energy consumption saving operating costs
- Fast signal processing even with changes in process conditions
- Modular electronics design with dual redundancy and 'plug and play' electronics exchange possible



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APPLICATION REPORT Food & Beverage

Custody transfer measurement of sugary syrup

- Measuring system as per MID MI-005
- Mass flow measurement of sugary syrup
- Space-saving installation with straight tube design



1. Background

UNIFERM is a domestic and international supplier of ingredients for bakeries. The company supplies the bakery trade and baking industry with a comprehensive range of products including baking yeast, baking agents for bread and rolls, baking agents for fine pastries and separating agents.

2. Measurement requirements

Sugary syrup is used as a raw material in the production of yeast. This syrup is subject to custody transfer in accordance with MID 2004/22/EC MI-005. Measurement of the liquid sugar must conform to these requirements. Local installation conditions are taken into account and the data is made available to regulatory authorities.

A Coriolis mass flowmeter was chosen due to limited space on-site and the required measuring range in which the system operates.

Measuring system	
Medium:	Sugar syrup
Measuring range:	1.7...7.0 t/h / 62.5...257.2 lb/min
Minimum measured quantity:	20 kg / 44 lb
Temperature:	+5...+25 °C / +41...+77 °F
Pressure:	2 barg / 29 psig



3. KROHNE solution

KROHNE provided a Coriolis mass flowmeter OPTIMASS 7300 C. It was supplied in a compact version featuring a Titanium measuring tube (DN 25). The OPTIMASS 7300 boasts a single straight measuring tube and was thus able to be installed very compactly in a confined space. The general requirements for measuring systems for liquids other than water were taken into account. The measuring system's compact design meant that having no inlet run was a possibility.

4. Customer benefits

The OPTIMASS 7300 C meets all custody transfer requirements according to OIML R117 and MI-005. The high linearity of the mass flowmeter as well as the associated maximum measuring accuracy allow for highly precise measurement in the specified measuring range while reducing costs for calibration.

5. Product used

OPTIMASS 7300 C

- Coriolis mass flowmeter for liquids and gases
- Highest accuracy for CT (MID 2004/22/EC MI-005)
Flow rates up to 430,000 kg/h / 15,800 lb/min
- Best in class for zero stability
- Tubes available in 4 materials
(Stainless steel, Titanium, Hastelloy®, Tantalum)
- Modular electronics concept
- Optional heating jacket
- OIML R117, MI-005, Inmetro, NTEP
- HART®, FOUNDATION™ fieldbus, PROFIBUS® PA and DP etc.



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APPLICATION NOTE Food & Beverage

Level measurement in starch production

- Storing bran in 20 meter high silos
- Permanent monitoring of bran stock for supply inventory
- Low operating costs due to simplified and maintenance-free installation

1. Background

The world's production of starch and its by-products currently amounts to 6.5 million tons per year. Obtained mostly from corn, wheat and potatoes, starch is used as an additive in various industries: e.g. food processing, papermaking, clothing, chemical and pharmaceutical industry. Several processes allow for the production of starch: One of them, called 'steeping', separates the peel from the grain by soaking it in water for several days. The grain peel is then dried before being shredded and used as an additive in animal feeds.



Corn as raw material for starch production

2. Measurement requirements

One of the largest starch producers in France processes 3 million tons of corn and 1.5 million tons of wheat every year. The shredded peel (bran) is stored in several 20 meter high silos before being added to the next process. To avoid interrupting the production process, the stock must be permanently monitored. Bran is generally a low reflective medium and there is always dust and condensation involved. This and the uneven product surface make reliable level measurement a challenging task. The previously tested devices from competition – a TDR guided radar level meter with cable probe and a Radar instrument with traditional horn antenna – had to be removed frequently for cleaning and much time was spent climbing up to the top of the silos. During the cleaning, the production cycle was interrupted causing financial loss. Therefore, the customer was looking for a maintenance-free solution.

3. KROHNE solution

KROHNE delivered 2 OPTIWAVE 6300 C with a DN 80 (3") Drop antenna made of plain PP and a G1½ process connection. Fitted on each silo roof, the non-contact radar (FMCW) level meters measure the level of bran and communicate the results to the DCS in the control room.

The OPTIWAVE 6300 C uses specific software algorithms for solids. Combined with the FMCW radar technology and the high signal dynamics of its electronics it allows for accurate and reliable level measurement even in dusty atmosphere and on a low reflective medium with an uneven or moving surface.



Drop antenna of the OPTIWAVE 6300:
Measurement is unaffected by dust deposit

4. Customer benefits

The starch producer benefits from a maintenance-free level meter as the ellipsoidal shape, smooth polypropylene surface and completely encapsulated design of the OPTIWAVE's Drop antenna is not affected by condensation and crusting. Therefore, interruptions of the production cycle and climbing on the silo roofs for periodic cleaning of the antennas are no longer necessary. As the level meter is unaffected by dust, measurements can also be taken during the filling process without the need for antenna aiming kits.

Since the OPTIWAVE 6300 C sends its accurate measuring values directly to the control room, the customer is now able to monitor its stock on a permanent basis. This enables the user to optimise supply inventory without the risk of overfilling the silo.

Thanks to the installation wizard, the meters are simple to set up and use. Being 2-wire devices, they also need less wiring. This reduces the installation and operating costs. Adding the competitive price of the OPTIWAVE 6300 C to all these advantages, this solution gives a fast return on investment.

The customer is very satisfied with the level meters. Another 14 silos of this production site will shortly be fitted with OPTIWAVE 6300 C and there is potential for 52 corn silos on other production sites of the company.

5. Product used

OPTIWAVE 6300 C

- 2-wire 24...26 GHz non-contact FMCW radar, ideal for solid applications
- No more purging systems: the Drop antenna made of plain PP or PTFE minimizes product build-up and condensation
- Measuring heights up to 80 m
- PACTware and DTMs available fully functional and free of charge
- Wizard driven setup
- Reduced installation costs



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APPLICATION REPORT Food & Beverage

Level measurement in flour silos with intense dust formation

- Monitoring of flour supplied for the production of frozen pizzas
- Non-contact (FMCW) radar level measurement of low reflective medium
- Significantly higher measuring performance in a test comparison with pulse radar devices



1. Background

Nestlé Wagner GmbH is among the largest manufacturers of frozen pizza in Europe. Today, the long-established company produces these baked goods with about 1400 employees at two locations in Nonnweiler, Germany.

Because the production facilities run in continuous operation, all of the individual production steps must always be executed without delay. This requires, among other circumstances, that all of the raw materials are always supplied in the necessary amounts. This includes the flour for the pizza dough, which Nestlé Wagner stores in several metal silos that are 12 m / 40 ft in height.

2. Measurement requirements

For optimum flour distribution and the accordingly production line planning, the silo equipment must be monitored continuously. Because flour is an adhesive medium associated with a high degree of dust formation, level measurement is demanding. At one of the two locations a measurement solution already had to be eliminated from the process because thick product deposits regularly resulted in measurement failures and high maintenance requirements. In addition, the measuring accuracy over the entire period was significantly limited due to the product surface of the medium, which has poor reflective properties (ϵ_r value of approx. 2).

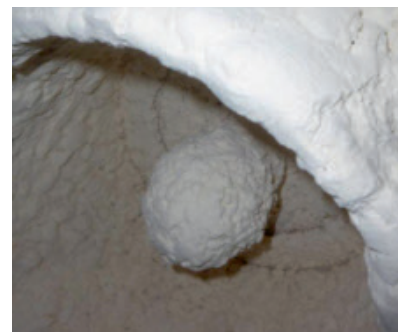
For this reasons, to record the tonnage reliably and as maintenance-free as possible in the future, the customer decided to test various level meters from several well-known manufacturers in parallel operation over a period of four months. All of the devices were non-contact radar level meters. All of the measuring solutions suitable for this application had to be approved in accordance with ATEX Ex iaD 20/21 for use in hazardous areas with dust and had to use materials that conform with FDA regulations.



3. KROHNE solution

During the test phase, the good measuring performance of the non-contact (FMCW) radar level meter OPTIWAVE 6300 C proved convincing. Moreover, the measuring instrument was the only one that did not require a purge connection. This was critical to the subsequent selection of the KROHNE device for level measurement on a total of seven flour silos.

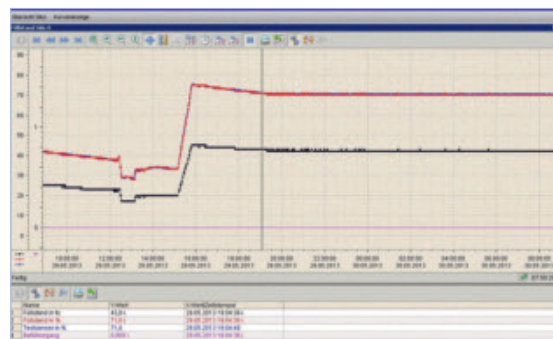
With its 24...26 GHz FMCW radar, the OPTIWAVE 6300 is designed for level measurement in the very dusty atmosphere of the flour silos. Each measuring device is equipped for this task with a DN 80 / 3" drop antenna made of PTFE. In order to measure the level directly from above, the existing nozzles (DN 80 / 3") on the roof of the silo were used in the installation.



Drop antenna of the OPTIWAVE 6300 in a flour silo

4. Customer benefits

With the OPTIWAVE 6300 C, Nestlé Wagner can monitor the supply of flour for the dough reliably. In this way, the device makes a significant contribution to guaranteeing the continuous operation of production. Its FMCW radar technology proved to have considerably higher performance in this application than other radar technologies such as pulse radar, for example, because despite the very demanding surface characteristics of this medium, with a very low ϵ_r value, the OPTIWAVE 6300 guarantees a strong signal in the silo and a high degree of measuring accuracy. Moreover, due to the low blocking distance of the OPTIWAVE 6300, a larger measuring range can be selected and the dead zone remains as small as possible.



The OPTIWAVE 6300 provides precise measured values, even during filling: red = value in percentage, black = value in tons

Another advantage of the non-contact measuring device is the drop antenna developed and patented by KROHNE. In contrast to the open horn antennas of other test devices, the OPTIWAVE 6300 does not require a purge connection that must be equipped with compressed air and a timing sequence. This saves the customer both increased expenses for installation and energy costs for compressed air over the long term. Due to the elliptical antenna form, the product deposits have only a very slight effect on the measuring result. In this way, the specialist for frozen pizza is able to prevent high maintenance requirements and process interruptions.

5. Product used

OPTIWAVE 6300 C

- Non-contact (FMCW) radar level meter for measuring the distance, level, volume and mass of solids
- Drop antenna made of PP or PTFE for use in dusty environments
- Specific installation assistant for accurate measurement with moving surfaces
- Measuring range up to 80 m / 260 ft



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APPLICATION REPORT Food & Beverage

Volume and mass flow measurements of liquids and gases in breweries

- Reliable flow measurements to ensure constant beer quality
- Measurements not influenced by different process conditions
- Precise and constant dosing of different additives at all production levels

1. Background

When constructing a large new brewery near Enschede, the Netherlands, the beer producer GROLSCH was looking for a variety of devices to measure the volume and mass of liquid and gaseous products.

The GROLSCH brewery placed high demands on the devices, particularly in terms of measuring accuracy, reliability and being maintenance-free. All of the devices had to be equipped with the PROFIBUS PA communication interface to communicate with the ProLeit process control system. On top of that, the measuring devices were all to be supplied by the same manufacturer if possible.



New construction of GROLSCH brewery near Enschede, the Netherlands

2. Measurement requirements

GROLSCH wanted to use electromagnetic flowmeters (EMF) to measure the volume flow of electrically conductive and liquid products. These devices would be used in production areas, fresh water and cooling circuits as well as in wastewater treatment plants.

The EMFs to be used in production areas were required to have industry-specific, hygienic process connections for the food and beverage industry. They also needed to be made of FDA-compliant materials, be certified according to EHEDG and 3A and cleanable using CIP and SIP.

The Coriolis mass flowmeters were required both for highly viscous as well as electrically non-conductive liquids and for gases. In the past, hops were processed in solid form as pellets. Today, hops extract in liquid form is used to improve the brewing process and achieve a more stable beer quality. The extract has a density of approx. 1.3 kg/l / 81.1 lb/ft³ at a viscosity of a few thousand mPa·s. By heating it up to approx. 45° C / 113° F it was able to flow with more ease through tempering to enable processing at low flow velocities.

They were also used to measure gaseous carbon dioxide in CO₂ recovery plants.



CO₂ recovery plant

3. KROHNE solution

3.1 OPTIFLUX: Electromagnetic flowmeters (EMF) from KROHNE

KROHNE supplied approx. 300 OPTIFLUX 6000 and 4000 electromagnetic flowmeters in a variety of sizes and with various pipe connections for use in the new GROLSCH brewery. Both the compact and remote EMFs feature a PROFIBUS interface to enable communication with the ProLeit process control system.

The majority of the EMFs supplied were hygienic OPTIFLUX 6000 devices. These devices are equipped with a gasket system which prevents the gaskets from expanding into the measuring tube when heated. Some of the remote and compact versions of this EMF are fitted with the IFC 300 converter which comes standard with the application and device diagnostic system to help the user properly install and operate the measuring devices. The sizes ranged from DN 2.5 / 1/10" ... DN 150 / 6" and included industry-specific connections for the food and beverage industry and operating temperatures up to 150° C / 302° F.



OPTIFLUX 6000 F in the freshwater circuit

OPTIFLUX 4000 flange devices were used in the brewhouse. These EMFs can be used up to 150° C / 302° F when mashing. The OPTIFLUX 4000 devices are also used in wastewater treatment. These EMFs are approved for use with water in addition to their approvals for the food industry. The OPTIFLUX 4000 EMFs are also fitted with the IFC 300 signal converter. Constant checks and information regarding the operating status help detect failures early on so that appropriate countermeasures may be implemented.

All OPTIFLUX 6000 and 4000 EMFs can be easily cleaned using SIP and CIP technology. The accuracy of better than 0.2% from the measured value leaves nothing to be desired.



OPTIFLUX 4000 F in a water circuit

3.2 OPTIMASS: Coriolis mass flowmeters from KROHNE

KROHNE supplied a variety of sizes of OPTIMASS 7000 and 3000 mass flowmeters with different pipe connections to measure liquid and gaseous products in the new GROLSCH brewery. The compact and remote versions of these Coriolis mass flow measuring devices are equipped with a PROFIBUS PA interface.

The OPTIMASS 7000 devices are used to dose the liquid sugar and hops extract as extremely high precision and measuring accuracy are needed to guarantee the constant quality of the beer. The straight single tube without flow splitter provides decisive advantages when it comes to dosing the highly viscous hops extract. Due to the extremely low pressure loss, it is possible to work with low flow velocities. This is particularly advantageous with shear sensitive and sensitive products. The OPTIMASS 3000 devices are used for measuring the carbon dioxide in the recovery systems and offer an accuracy of up to 0.1%.

The OPTIMASS 7000 and 3000 devices can be easily cleaned using SIP and CIP technology. In addition to measuring mass and volume flow, the OPTIMASS devices can also measure current density and temperature. This makes it possible to calculate derived parameters such as Brix and Plato.



OPTIMASS 7000 F and 3000 F measuring gaseous carbon dioxide

4. Customer benefits

The process control system at GROLSCH measures and controls all of the areas and processes in the brewery. This includes the silo system, the brewhouse, fermenting and storage cellars, filtration and wastewater systems as well as decentralised CIP stations. The preparation and supply of media are also included. KROHNE volume and mass flowmeters perform admirably here. All devices are fitted with PROFIBUS PA.



OPTIFLUX 4000 F in the brewhouse

5. Products used

5.1 Electromagnetic flowmeters from KROHNE

OPTIFLUX 6000

- Hygienic and aseptic stainless steel version featuring unique gasket design
- Suitable for all CIP and SIP processes
- All industry-specific pipe connections
- PFA liner reinforced with stainless steel mesh for high dimensional stability and vacuum resistance
- Standard sizes DN 2.5...DN 150, corresponds to 1/10" ...6"
- EHEDG and 3A-approved
- Wet-calibrated on officially certified calibration rigs according to EN 17025



OPTIFLUX 4000

- Measuring sensor for the process industry
- Sturdy and reliable, even at high temperatures up to 150° C / 302° F
- Electrical conductivity: water from 20 µS/cm, other liquids from 1 µS/cm
- Simple installation and start-up
- Standard sizes DN 2.5...>DN 1000, corresponds to 1/10" ...>40"
- Wet-calibrated on officially certified calibration rigs according to EN 17025



5.2 KROHNE mass flowmeters

OPTIMASS 7000

- Only mass flowmeter with a single straight measuring tube made of stainless steel, Hastelloy®, titanium or tantalum
- Minimal pressure loss
- Reliable measurement of mass and volume flow, density, temperature, concentration for liquids, even with solid content
- Any installation position, self-draining, easy to clean even using CIP and SIP, maintenance-free
- High measuring accuracy even with changing process conditions, outstanding zero point stability
- Compact and remote version



OPTIMASS 3000

- First choice for applications with low flow volume
- One installation length for all three sizes
- Z-shaped measuring tube made of Hastelloy® or stainless steel
- All common process connections available, including hygienic connections
- Certified secondary containment in Stainless Steel 316L
- Self-draining and easy to clean, even using CIP and SIP, maintenance-free
- Simple installation and start-up



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APPLICATION REPORT

Food & Beverage

Measuring alternating media in the mash filter of a brewery

- Separating wort from mash slurry in the lautering process
- Monitoring media change from sugary wort to spent grain (malt)
- Detecting spent grain passing through the filtration system to trigger process shutdown



1. Background

The Brasserie St-Feuillien is a Belgian brewery famous for their internationally acclaimed ales. Their various types of beer are brewed at a production site located in Le Roeulx, in the French speaking part of Belgium.

The facility uses the traditional way of brewing which basically consists of malting, worting and fermentation: In a first step barley is malted, i.e. it gets steeped in water, germinated and then dried (kilned). The malt is then converted into fermentable sugars by mixing it with water. The mashing process results in a sugar rich liquid called wort, which is then separated from the spent grains in the lautering process. Only after the liquid is extracted from the malt can it be boiled with hops in the worting kettle, fermented and further processed to produce beer.

2. Measurement requirements

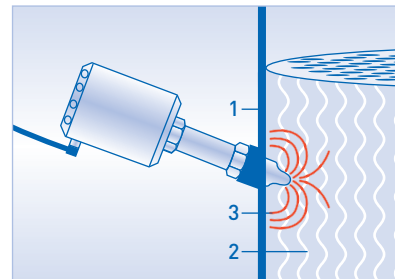
For the separation of the wort from the malt the Brasserie St-Feuillien uses a membrane free mash filter. In order to find out when it is no longer efficient to extract more wort from the mash, the filtering process needs continuous monitoring. Once the sugary liquid is drained and the insoluble grains start passing through the filter, the mash filter has to be put on hold to secure product quality. Therefore, the customer was looking for a technical solution to detect a change of medium from the sweet wort to the clogging malt.

KROHNE

3. KROHNE solution

KROHNE recommended using the OPTISWITCH 6500. The device was delivered as a long version (250 mm/ 9.8") with G½ process connection. It was welded in the mash filter using a welded sleeve (HWN 200).

The switch uses a high frequency signal sweep that is radiated from the sensor tip into the mash filter. The medium acts as a virtual capacitor, which together with a coil in the sensor head, forms a circuit creating the switching point signal. This virtual capacity will depend of the dielectric value of the medium. With the help of a configuration tool the switching point of the OPTISWITCH 6500 was quickly fine-tuned. The switching point is accurately defined and when the switch comes into contact with the grain, its switching point is triggered. This information is indicated by an LED which shines through the housing cover.



1 Wall of mash filter, 2 Medium, 3 Line of electric flux

4. Customer benefits

The OPTISWITCH 6500 ensures that the wort extraction is as free from malt bits as possible, thus helping the Brasserie St-Feuillien run the lautering process efficiently and maintain the highest product quality. Both types of medium are always well detected so that immediate steps can be taken, if the malt starts passing through the filter press.

Given the sticky spent grain, it is an additional advantage to the customer that the device is easy to clean and the risk of clogging products is minimised. The OPTISWITCH 6500 doesn't need any maintenance. Its measuring performance is not affected by its mounting position and it is resistant against CIP and SIP agents which have to be applied by the brewery on a regular basis.

The customer is very satisfied with the OPTISWITCH 6500. The switch is part of a whole instrumentation package of KROHNE products for various brewing processes at ST-Feuillien.

5. Product used

OPTISWITCH 6500

- Hygienic switch for level detection and dry-run protection
- Measures alternating media
- Excellent for media separation
- Insensitive to build up or foam
- Hygienic switch completely in Stainless Steel
- Process temperature -40 ...+200°C / -40...+392°F



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APPLICATION REPORT Food & Beverage



Flow measurement on a flash pasteuriser

- Pasteurisation system for up to 60,000 l/h (ca. 15,850 US gph) beer, juice or soft drinks
- Electromagnetic flow measurement for the automated control of heat retention times
- Efficient use of hot water corresponding to beverage flow rate

1. Background

KHS GmbH is one of the world's leading suppliers of filling and packaging systems as well as technical systems for the beverage industry. This includes fully-automated flash pasteuriser such as the Innopro KZE C. This system makes it possible to heat liquid foods to a minimum of +72 °C / +161.6 °F or up to +120 °C / +248 °F (high-temperature pasteurisation). That means that microorganisms and germs in beer, juice and soft drinks are killed, considerably increasing the shelf life of these beverages even without cooling.

2. Measurement requirements

In the Innopro KZE, hot water is circulated at a regulated temperature using a system of plate heat exchangers and steam while maintaining a constant temperature. In the heating section the beverage is heated in a counterflow and brought to pasteurisation temperature. Following flash pasteurisation the microbiologically impeccable drink is cooled and transferred to the filler.

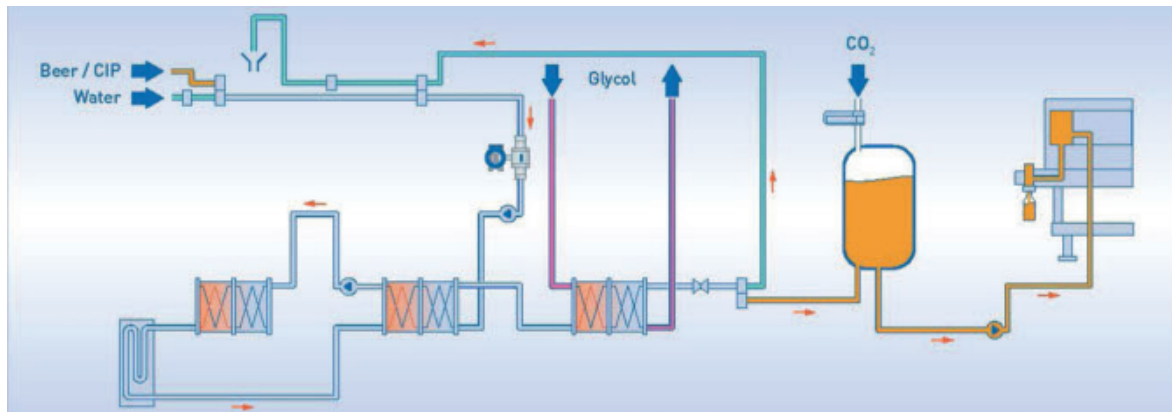
The Innopro KZE controls the pasteurisation fully automatically according to the beverage flow (up to 60,000 l/h, ca. 15,850 US gph). To do this the system must be fitted with a hygienic flowmeter that transmits the measured values via a Profibus interface to the higher-ranking control unit.



3. KROHNE solution

KHS equips the Innopro KZE with the OPTIFLUX 6300 C. The electromagnetic flowmeter (EMF) continuously measures the flow of the respective customer-specific beverage. The measuring device has been designed for hygienic applications in the food and beverage industry and measures extremely accurately with a deviation of 0.2% (of the measured value), even with beverages with a high fibre and fruit content.

The OPTIFLUX 6300 C transmits the measured values digitally via Profibus interface to the control unit (PLC) of the end customer. Thanks to the comprehensive diagnostic functions of the KROHNE device, all parameters and operating states can be determined and further processed at any time.



Process description of flash pasteurisation with the OPTIFLUX 6300 C

4. Customer benefits

Using the OPTIFLUX 6300 C enables consistent and gentle pasteurisation. The heat retention time and use of hot water can be automatically controlled via the flow rate. In this way, the OPTIFLUX 6300 C contributes to the making of a safe product as well as consistent, cost-efficient production.

In the past KHS has successfully used the OPTIFLUX 6300 for other systems (e.g. for beer stabilisation). The measuring device met expectations in this application as well. Thanks to the high-performing measuring technology and accompanying application-focused services, KROHNE has qualified as the standard supplier for flowmeter technology at KHS GmbH.

5. Product used

OPTIFLUX 6300 C

- Electromagnetic flowmeter for the food and beverage industry
- For demanding mixing, dosing and filling applications with liquids
- Robust stainless steel housing and PFA liner
- DN 2.5...150 / 1/10...6"; process temperature up to 140 °C / 284 °F
- All industry-specific process connections
- On-site verification of flowmeter with OPTICHECK
- 3A, EHEDG; FDA, EC 1935/2004
- HART®, FOUNDATION™ fieldbus, Profibus® PA and DP, Modbus etc.



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APPLICATION REPORT

Food & Beverage

pH monitoring in alcoholic fermentation

- Distilling traditional alcohols from sugar beet syrups
- Inline pH measurement for process control
- Cost saving installation of sensor with integrated transmitter technology



1. Background

Tereos France is a world leading producer of sugar and one of Europe's main manufacturers of starch-based products and alcohols. Among others, the company operates several distilleries of which one is located in Val des Marais, in Northern France, where agricultural raw materials are turned into traditional alcohols.

Prior to the main distillery processes, low-purity syrups with a sugar content of 55...65% are extracted from sugar beet and subsequently transformed into alcohol ("wine") of 5...13 Vol.-% for further processing. The fermentation process is carried out in 7 tanks. For the desired degree of alcohol, these tanks are kept at 32...37 °C / 90...99 °F. This way, the distillery produces about 200m³ of "wine" per day.

2. Measurement requirements

The best fermentation condition is maintained at a pH value of between 2.5 and 4. For this reason it is very important that the pH value of the low-purity syrups in the tanks is monitored on a regular basis. The customer therefore established a pH measurement cycle (7 samples, 1 cleaning; cycle time: approx. 1 hour). Samples taken manually also get checked in a lab every two hours. If the pH value rises above 4.5, sulfuric acid and phosphoric acid (nutrient) have to be added to prevent the growth of bacteria, which can contaminate the alcohol solution. Tereos previously used a pH sensor from an alternative supplier for this application, however the sensor and external transmitter were affected by hydraulic shocks caused by the medium. The liquid entered the transmitter via the cable gland and damaged the device. This interrupted process monitoring which also had an impact on the acid dosage as the dosing pump stopped working. The rise of the pH value could not be prevented effectively and the performance of the dosing pump could not be controlled. Therefore the customer looked for a new solution capable of measuring pH reliably at high pressure conditions of around 5 barg / 72.5 psig.

KROHNE

3. KROHNE solution

KROHNE offered SMARTPAT PH 2390. The pH sensor was installed directly into the pipe. The rugged sensor design makes this sensor type suitable for this application because of the high pressure resistance of up to 6.9 bar / 100 psi. It can be easily adapted to such harsh applications with alcoholic solutions.

The 2-wire loop powered SMARTPAT PH sensor features integrated transmitter technology. The entire transmitter technology is miniaturised and fits into the sensor head, eliminating the need for an external transmitter. The SMARTPAT PH sensor stores all data and sends these as bidirectional digital signals with 4...20 mA / HART® directly to a PLC that controls the dosing pump.

4. Customer benefits

Tereos now benefits from a stable pH value that helps them maintain the best fermentation conditions for their alcohol production. An accurate dosing of nutrients is guaranteed in case the pH value rises above 4.5. The dosing pump no longer stops due to a damaged pH sensor and its performance can now be reliably monitored. The mechanical protection of the sensor prevents product entry and guarantees operational safety.

Given that the SMARTPAT PH 2390 features integrated transmitter technology, the investment costs of the complete measuring loop is significantly reduced in comparison to the previous measuring system that needed a separate transmitter. Maintenance and costs are also reduced because the sensor can be configured and calibrated offline in the laboratory under controlled conditions. Calibration errors and cumbersome sensor handling on-site are no longer an issue. The sensor can be cleaned and regenerated to extend the lifetime.

Tereos stands to gain from the single source supplier KROHNE that does not only provide the sensors but the whole range of professional equipment (e.g. buffer solutions) as well as consulting services.



SMARTPAT PH 2390 installed between a hydrometer (left) and a redundant probe (right)

5. Product used

SMARTPAT PH 2390

- 2-wire loop powered sensor with integrated transmitter technology
- Special sensor design for harsh applications
- Low maintenance cost and long service cycle
- Large PTFE diaphragm for reliable pH measurement
- Double junction for extended life time and a wide application range
- With integrated Pt1000 and standard VP2 connector



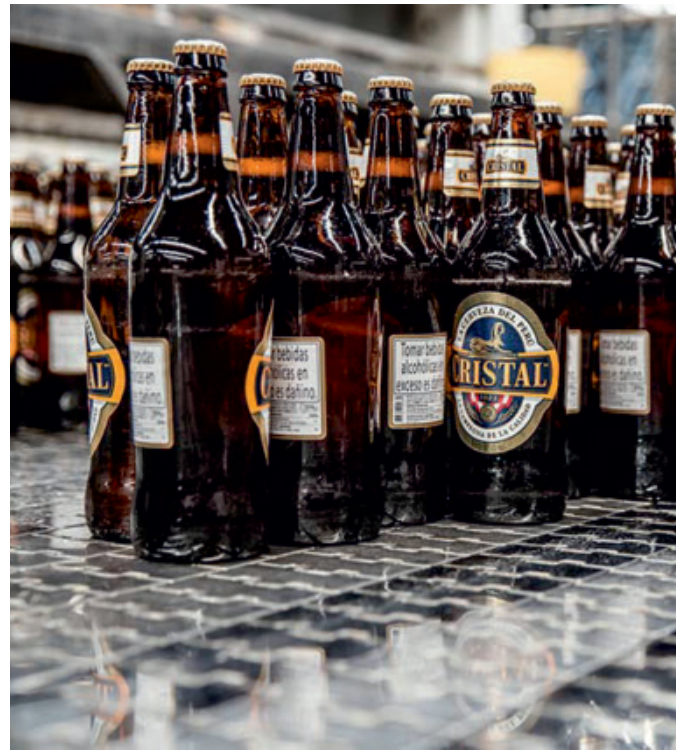
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APPLICATION REPORT

Food & Beverage

Flow measurement of bright beer with high CO₂ content

- Coriolis mass flow and density measurement of beer transferred to the bright beer tank (BBT)
- Maintaining operation even with high levels of entrained gas (CO₂)
- Accurate and consistent measurement results from the start to the finish of the batch



1. Background

Bacus, a leading company in the Peruvian beer and beverage market, is part of the global brewing giant AB InBev. With five beer production plants located in Lima (Ate), Arequipa, Cusco, Motupe and Pucallpa, Bacus produce some of the country's most popular beers and non-alcoholic beverages. Their brand portfolio includes Cristal, Pilsen Callao, Cusqueña, Backus Ice, Pilsen Trujillo, Arequipeña, San Juan, Fiesta Real, Abraxas, Miller Genuine Draft, Peroni Nastro Azzurro and Grolsch.

2. Measurement requirements

Bright beer is the clear beer that forms after primary fermentation when the yeast drops out of suspension. It is stored in the bright beer tank (BBT) or serving tank before being packed in kegs, bottles or cans.

The brewery was searching for a flowmeter to continuously and reliably measure the beer flow to the BBT. The presence of CO₂ in the various types of beer makes this a very challenging application particularly at the start and finish of the batch.



Bright beer tank (BBT)

KROHNE

3. KROHNE solution

After testing Coriolis meters from a number of leading manufacturers, Backus found that the OPTIMASS 6400 C with Entrained Gas Management (EGM™) delivered the most accurate and consistent measurement results. The adverse process conditions had caused other Coriolis meters to go into re-start mode or “freeze”. Despite the wide range of gas volume fractions found in the process the OPTIMASS 6400 maintained operation allowing the process to continue uninterrupted.

The 6400 meter is able to measure sudden changes in density caused by changing CO₂ levels and gives an alert when two phase flow is detected allowing continuous measurement.



Installation of OPTIMASS 6400 (DN100 / 4") with SMS connections for hygienic flow measurement of bright beer

4. Customer benefits

Backus is very satisfied with the performance of the OPTIMASS 6400 and EGM™ function which solved the entrained gas problems that had been disrupting production. While the other Coriolis manufacturers claimed similar features they were found to fail when tested. KROHNE's EGM™ solution is now the standard for this challenging process in all Backus plants in Peru.

EGM™ continues to prove itself in challenging entrained gas applications even with larger line size meters such as the DN100 / 4" now in use with Backus.

5. Product used

OPTIMASS 6400 C

- Twin bent tube Coriolis mass flowmeter for flow and density measurement of beer to bright beer tanks (BBT)
- Entrained Gas Management (EGM™): continuous measurement across a wide range of gas fractions and challenging process applications
- Certified for hygienic applications (EHEDG, 3A)
- Available with various hygienic connections
- Digital communication options: HART®, FOUNDATION™ Fieldbus, PROFIBUS®-PA/DP and Modbus



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APPLICATION REPORT Food & Beverage

Measuring the suspended solids content in bottom-fermented brewer's yeast

- Determining the switching point for separating excess yeast and wort
- Process control between the fermentation and storage of green beer
- Use of TSS measuring system and flowmeter for minimal product loss



1. Background

German company Wellmann Engineering develops and manufactures process solutions for all areas of the food industry as well as the pharmaceutical industry. The international process specialist constructs, for example, turnkey systems for production processes in the brewing sector.

2. Measurement requirements

Wellmann has supplied a mobile measuring and control unit for a family brewery in Southern Germany. The purpose of this mobile unit is to determine the right time to separate the yeast from the green beer. Following the fermentation process, i.e. the conversion of maltose to CO₂ and alcohol, the excess yeast settles at the bottom of the fermentation tank and can be removed. The green beer separated from the yeast is then channeled into a storage tank for further maturing.

Wellmann's mobile unit is connected to the brewing tank by a flexible hose. To keep product loss to a minimum when removing the yeast, it is important to determine the correct switching point from which the flow of brewer's yeast converts to green beer. To this end, Wellmann was looking for a suitable measuring instrument that could be permanently fitted to the measuring and control unit.

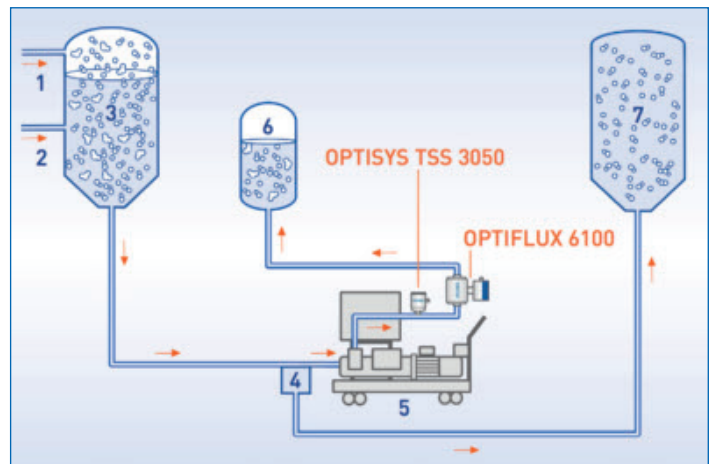
3. KROHNE solution

Wellmann equipped the mobile system with the OPTISYS TSS 3050 total suspended solids measuring system. This compact measuring device is optimally designed for separation and filtering processes in the food industry. The optical sensor of the KROHNE system detects the media change from brewer's yeast to green beer based on the turbidity level, i.e. the light absorption caused by solid contents in the beer. To this end, the measuring system was configured to a measuring range of 0...3250 EBC.



The measuring system features an elastomer-free hygienic process connection and thanks to its sturdy construction is also suitable for CIP (Cleaning in Place) and high-pressure cleaning (IP69K).

The mobile measuring and control unit was also fitted with the OPTIFLUX 6100 C so that it can measure the volume flow of the brewer's yeast too. This electromagnetic flowmeter is a standard instrument for food and beverage applications. The EHEDG-approved and 3A-certified flowmeter was fitted to the trolley with a hygienic connection in compliance with DIN 11864.

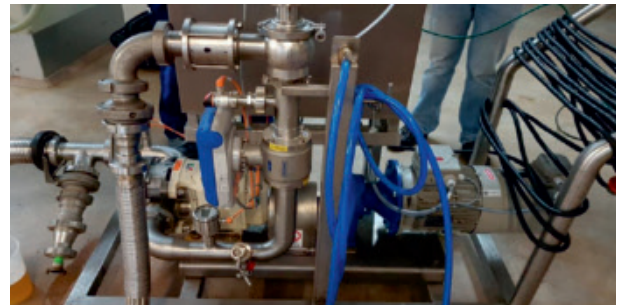


1 Yeast; 2 Wort; 3 Brewing tank; 4 Connection nozzle for pipe to storage tank; 5 Mobile measuring and control unit; 6 Yeast collecting tank; 7 Storage tank

4. Customer benefits

The interface can be effectively determined using the TSS measuring device for removing the yeast. The fast response time of the KROHNE device ensures that the pump is switched off as soon as only the green beer flows through the pipe. Product loss/waste is kept to a minimum.

Thanks to the electromagnetic flow measurement, the brewery now also knows the total volume flow of brewer's yeast that has been removed. The measuring data is displayed on the mobile measuring and control panel for monitoring purposes.



Mobile measuring and control unit with OPTISYS TSS 3050 and OPTIFLUX 6100

5. Products used

OPTISYS TSS 3050

- Total suspended solids measuring system for hygienic applications
- Process connection: G1/2 for hygienic adapters
- Hygienic stainless steel design, suitable for CIP/SIP
- Max.: 3 AU, 6 OD, 13000 FAU, 13000 FTU, 3250 EBC, 26.65 g/l
- 4-wire, 4...20 mA, with integrated transmitter



OPTIFLUX 6100 C

- Electromagnetic flowmeter for standard hygienic applications
- Reliable dosing and filling in the food sector
- Nominal size: DN2.5...150 / 1/10...6"
- Available with industry-specific installation lengths and various hygienic process connections
- Certified to 3A, EHEDG; complies with FDA and EC1935/2004 regulations



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APPLICATION REPORT Food & Beverage

Equipping a PVPP beer stabilizing system with flow measurement technology



- Fully automated beer stabilization through the removal of polyphenols
- Electromagnetic flow measurement for the dosing of polyvinylpolypyrrolidone (PVPP)
- Profibus communication for process control and system visualisation via a PLC

1. Background

KHS GmbH is one of the world's leading suppliers of filling and packaging systems as well as technical systems for the beverage industry. In addition to components for filling, cleaning and packaging liquids, KHS also supplies industry-specific process technology. This includes fully-automated systems to stabilize beer in container format.

2. Measurement requirements

For small and medium-sized breweries KHS manufactures the Innopro ECOSTAB B, a beer stabilization system for batch processing. The system removes the phenols that cause turbidity from the beer by way of renewable PVPP (polyvinylpolypyrrolidone). This allows the beer to be stabilized accordingly and prevents turbidity during transport or long periods of storage. The PVPP suspension is provided in a stackable container. Since this system stabilizes the beer in small process modules, the mixing phases and product consumption are accordingly low.

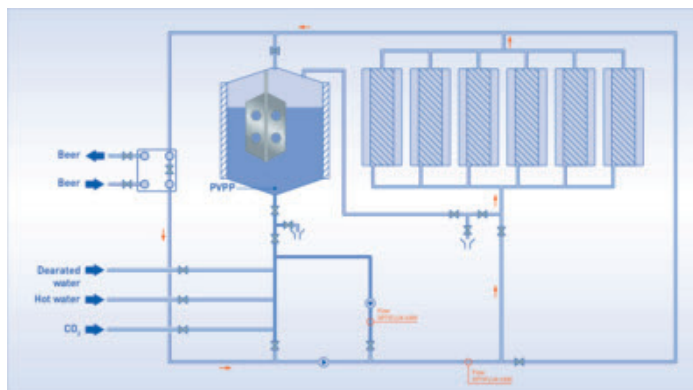
Following successful stabilization the PVPP is regenerated in the modules and fed back to the dosage tank so that it may be reused for the next stabilization cycle. In order to dose the PVPP properly in relation to the overall volume flow of 50...240 hl/h (ca. 42.6...204.5 US beer bbl) and to enable automated operation, the system must be equipped with flowmeters.

3. KROHNE solution

KHS chose KROHNE's OPTIFLUX 6300 as its flowmeter. For this plant manufacturer, KROHNE is the standard supplier of flow instrumentation. The two companies have enjoyed a long partnership. The electromagnetic flowmeters have been in use for a long time for other KHS products such as filling systems.

A total of two devices were used in the system. One compact version (C) and one version with a remote converter and wall housing (W). The PVPP is then either dosed in proportion to quantity using an OPTIFLUX 6300 W in a small size (DN 10) or the exact amount is added to the flow of beer on top while regulating the turbidity. An OPTIFLUX 6300 C (DN 40) also measures the overall volume flow of the beer to be stabilised.

Both device versions feature a state-of-the-art Profibus DP interface and use it to digitally transmit all of the measured parameters to the higher-ranking PLC.



Beer stabilization with the OPTIFLUX 6300

4. Customer benefits

Dosing the PVPP is accurate and fully-automated when using the OPTIFLUX 6300. The higher-ranking PLC makes it possible for the plant operator to quickly measure and further process all parameters and operating states of the OPTIFLUX 6300 via the Profibus DP. The entire dosing process can be centrally adjusted and visualised along with the entire system.

The high accuracy of the measuring device with a deviation of <math><0.2\%</math> from the measured value ensures high plant safety and cost-saving operation. The PVPP is carefully dosed into the beer flow according to the dosing quantity in the formula.

5. Product used

OPTIFLUX 6300 C and W

- Electromagnetic flowmeter for the food and beverage industry
- For demanding mixing, dosing and filling applications with liquids
- Robust stainless steel housing and PFA liner
- DN 2.5...150 / 1/10...6"; process temperature up to 140 °C / 284 °F
- All industry-specific process connections
- On-site verification of flowmeter with OPTICHECK
- FDA, EC 1935/2004; 3A; EHEDG
- HART®, FOUNDATION™ fieldbus, PROFIBUS® PA and DP, Modbus etc.



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APPLICATION REPORT Food & Beverage

Portable flow measurement of wine and juice

- Electromagnetic flow metering to automate transfer operations
- Monitoring the quantity of juice and wine moved from one tank to another
- Highly flexible solution for temporary flow measurement and pump control

1. Background

Based in Tenterden in Kent, England, the award winning Chapel Down winery produces truly world-class Traditional Method sparkling wines and a range of still wines, as well as premium beer and cider. They boast some of the best winemaking facilities in England.

2. Measurement requirements

Daily work at the winery frequently involves transfer operations where wine or juice is moved from one tank to another. In order to monitor the quantity of transferred products as well as to control the pump accordingly, Chapel Down previously used sight glasses running down the side of the tank. However, this manual way of checking was labour intensive.

The winery operator was therefore looking for a portable measurement device that could provide accurate measurement and volume monitoring of juice and wine during those transfer operations. Josh Donaghay-Spire, winemaker at Chapel Down, specifies: "We were keen to automate the transfer process, however we needed a flowmeter that could cope with dissolved CO₂, as this makes the more traditional flowmeters ineffective."

3. KROHNE solution

After careful consideration, they decided to have a portable device manufactured that incorporated KROHNE's OPTIFLUX 2100 C electromagnetic flowmeter. The device consists of the OPTIFLUX 2100 (DN 32 / 1¼") attached to an inlet and outlet pipe and mounted on wheels. The device can then be easily moved around the winery to perform accurate measurement wherever it is required. The inlet pipe is attached to a tank and the medium is then pumped through it at a flowrate of 5...10,000 l/hr [1.32...2642 gal (US)/h]. It passes through the electromagnetic flowmeter and then via the outlet pipe into another vessel. The OPTIFLUX 2100 accurately measures the volume of the medium and once the desired quantity has been reached the pump is switched off.



Portable measuring device incorporating the OPTIFLUX 2100

4. Customer benefits

By automating the process using KROHNE's OPTIFLUX 2100, the Chapel Down winery now has consistently accurate measurement and instead of two people being required to carry out the transfer operation, the process can be carried out by one person alone.

Josh Donaghay-Spire of Chapel Down comments, "We were aware that KROHNE had previous experience with a similar application and that their OPTIFLUX 2100 could easily cope with the process conditions whilst providing accurate and reliable measurement. We can now not only make more efficient use of manpower but we can also calibrate certain tanks which previously didn't have calibration charts."

5. Product used

OPTIFLUX 2100 C

- Electromagnetic flowmeter
- Bi-directional flow metering
- Tamper proof, fully welded construction
- Also available in customer specific constructions
- Standard in house wet calibration of sensors up to DN3000 / 120"
- Extensive diagnostic capabilities
- Maintenance-free
- On-site verification of flowmeter with OPTICHECK



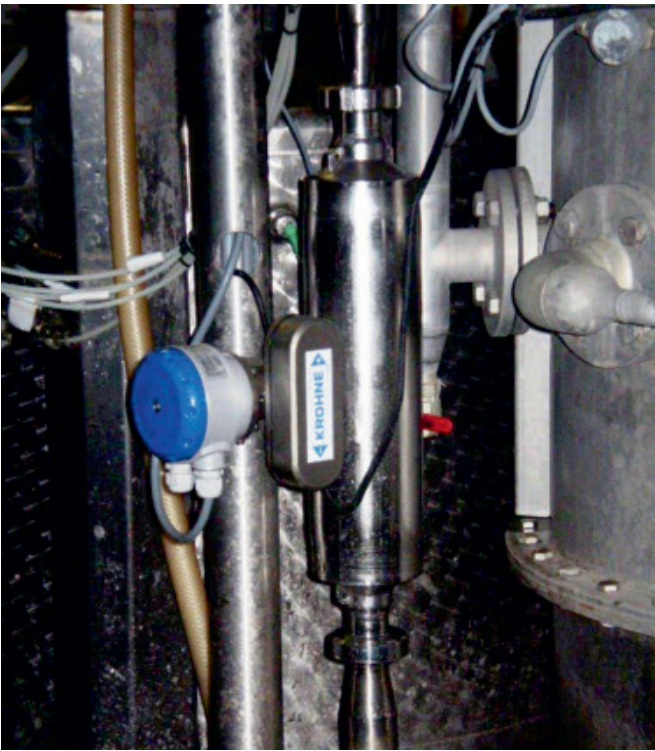
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APPLICATION REPORT Food & Beverage

Flow measurement of potato mash in Vodka production

- Measuring the volume flow rate of fermented mash fed into the distillation column
- Reliable solution to automate the process and reduce production time
- Monitoring the feedstock to finished product ratio

1. Background

The family run Chase distillery, located in Hereford, England, produces the award winning Chase Vodka which is the World's first super premium English potato Vodka. The entire process from seed to bottle takes place on the Chase estate ensuring that a close eye can be kept on all stages from growing the potatoes to distilling and bottling.

2. Measurement requirements

Vodka production involves a fermentation process starting with the mashing of potatoes and the addition of a brewer's yeast. After about a week, the fermented potato mash is distilled four times in a bespoke copper batch pot and then twice more in a rectification column. In the past, the distillery used a manual method to monitor the flow of fermented potato mash into the distillation column. However, it was planned to automate the process, so Chase were looking for a flowmeter that was capable of measuring the flow rate of the medium at the distilling stage.

The density of the medium going through the meter can vary from 0.95 to 1.1kg/l / 59 to 69 lb/ft³ and flows at a rate of 2000 l/h / 54 lb/m with pressure of 1 barg / 15.5 psig at a temperature of 30 °C / 86 °F. With the available space being limited, Chase required a meter that had a small installation envelope, but could still measure accurately and was capable of being CIP cleaned at 65 °C / 150 °F.

3. KROHNE solution

After careful consideration, the Chase distillery decided on KROHNE's OPTIMASS 1300. The Coriolis mass flowmeter was installed in a vertical pipe run feeding the distillation column. The OPTIMASS 1300 has a dual straight tube design which makes it ideal for use in hygienic applications as there are no crevices or bends for bacteria to gather and the meter can be easily drained and cleaned. Due to the hygienic nature of the application the OPTIMASS 1300 was supplied with hygienic fittings and also has all of the necessary hygienic industry approvals. Initially, the OPTIMASS 1300 has been used with a local display. However, in the future it is planned to interface the meter with the PLC using mA outputs to measure volumetric flow, density and temperature.

4. Customer benefits

The OPTIMASS 1300 has enabled Chase to monitor the feedstock to finished product ratio accurately. Since installation it has also reduced production time by highlighting an underperforming feed pump that was increasing the mash charging time which in turn lengthened the production time.

Tim Nolan, engineering manager at Chase, is very pleased with the performance of the OPTIMASS 1300, "Installing the KROHNE meter has meant that we can automate the process and ultimately reduce production time. It also allows us increased flexibility as we can install the meter on other parts of the process to verify efficiency," he continues, "KROHNE have supplied us with a meter that complies to our hygienic requirements and has proved to be very reliable."



Fermented potato mash measurement with the OPTIMASS 1300

5. Product used

OPTIMASS 1300

- Coriolis mass flowmeter for standard food and beverage applications
- Cost effective solution for accurate measurement of mass flow, density, volume, temperature, volume concentration or solid content
- With innovative twin measuring tubes and an optimised flow divider for minimum pressure loss
- Supports a wide range of industry standard hygienic connections
- Resistant to installation and process effects
- Easily drained and easy to clean
- Modular electronics with data redundancy



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APPLICATION REPORT Food & Beverage

Flow measurement of whisky

- Equipping a bottling plant for single malt whisky with flow instrumentation
- Cost-effective measurement with twin-straight tube Coriolis mass flowmeter
- Various measuring tasks – from monitoring tanker offloading to controlling the volumetric amount of spirits transferred to blending and bottling areas.



1. Background

The Glenmorangie Company Ltd is one of the most famous producers of Scottish single malt whisky. Their critically acclaimed products range from the Original Glenmorangie 10-, 18- and 25-year-old whiskies to special cask, extra matured and a range of limited edition whiskies.

All of the Glenmorangie whiskies are produced and matured in casks at the Glenmorangie distillery near Tain, Ross-shire, in the Scottish highlands. After maturation, the whiskies are sent to the company's bottling plant in West Lothian, near Edinburgh.

2. Measurement requirements

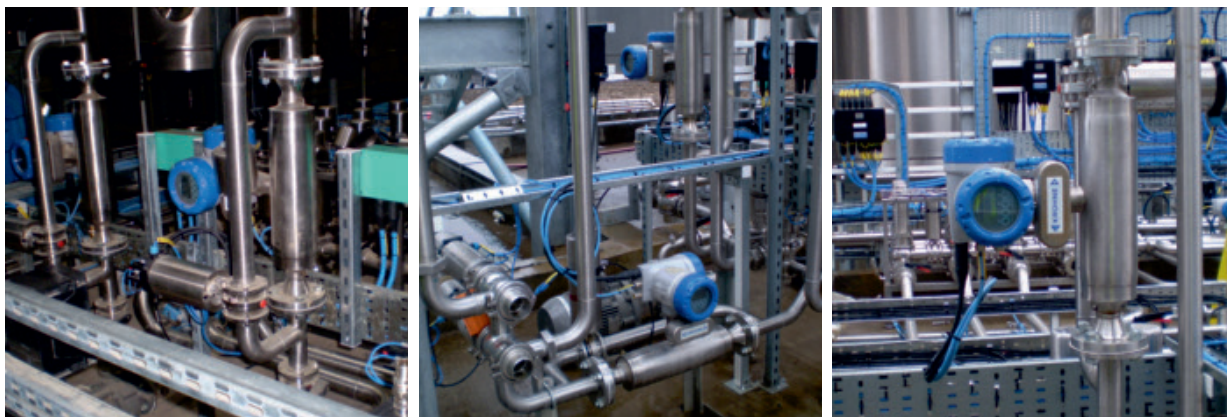
At the bottling plant, the whisky is offloaded and stored before being taken to the bottling areas. In order to increase efficiency and to continuously monitor the various volumetric flows, Glenmorangie were looking for a flowmeter to perform the various measuring tasks. The customer required the meter to be both cost-effective and accurate.

Medium Flow rates	Whisky 1,000...60,000 l/h 264... 15,850 gal (US)
Density	866...914 kg/m ³ 7.2...7.6 lb/gal (US)
Viscosity	1.2 cP
Temperature	+15...+25 °C +59...+77 °F
Pressure	3...7 barg 43.5...101.5 psig

KROHNE

3. KROHNE solution

The OPTIMASS 1300 C Coriolis mass flowmeter could fulfil all of Glenmorangie's requirements. A total of thirteen flowmeters were installed in their bottling plant. Two meters (DN 50 / 2") are used for offloading the tankers which come from the distillery. Three meters (DN 40 / 1 ½") measure the spirit taken from the storage to the blending area. The remaining eight meters (DN 25 / 1") are used in the blending process and on the final product for bottling. All mass flowmeters have been provided with stainless steel measuring tube.



OPTIMASS 1300 C measuring single malt whisky

4. Customer benefits

The OPTIMASS 1300 C helps Glenmorangie improve the bottling processes of their plant. Besides the great deal of information provided by the meter to control the various process flows, Glenmorangie stand to gain from numerous other benefits. Compared to other entry level mass flowmeters it has an outstanding price/performance ratio. Its accuracy ($\pm 0.15\%$) is far higher than competitors' lower cost meter ranges, thus meeting exactly what the customer was looking for.

Due to its twin-straight tube design, the OPTIMASS 1300 C is also much easier to install than bent tube meters as it requires a much smaller footprint. There were no installation restrictions for the KROHNE meter, so it fits perfectly with the environment of Glenmorangie's bottling section. A further advantage of the meter design is that it allows self-draining, so there are no additional steps for the customer to take to remove traces of previous product flows through the meter tube.

5. Product used

OPTIMASS 1300 C

- Coriolis mass flowmeter with twin straight tube design for applications with spirits
- Mass, volume and density measurement at blending and bottling areas
- Best price/performance ratio of its class
- With optimised flow divider for low pressure loss
- DN 15...100 / ½...4"; PN100 / ASME Cl 600 lb
- Immunity to crosstalk: resistant to installation and process effects
- On-site verification of flowmeter with USB powered verification tool OPTICHECK
- HART®, FOUNDATION™ fieldbus, PROFIBUS® PA and DP, Modbus etc.



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APPLICATION REPORT Food & Beverage

Equipping a cheese dairy with flow, level and analysis instruments

- Automation of a production site for premium cheese
- Providing information on various plant operations – from raw milk reception to cheese preparation to sterilisation and wastewater management
- Cross-company and cross-country project management to fulfil customer requirements on time



1. Background

Royal-Aware, a family-owned Dutch business, specialises in the maturation, cutting, wrapping, storage, transportation, and sale of cheese and other food products. With the ambition to become the best value supply chain partner in the food and agricultural business in Europe, the company also started their own cheese production in 2015. Their state-of-the-art cheese factory in Heerenveen, The Netherlands, allows Royal-Aware to develop up to 80 specific recipes and provide customers with tailor-made cheese products. The cheese dairy has a production capacity of up to 100,000 t/year.

2. Measurement requirements

The complete project management and engineering was done by Royal-Aware themselves, starting construction in 2013. Process technology and components were supplied by several suppliers according to the companies' specifications.

With regard to process measuring technology, only a partner with ample experience in cross-company and cross-country cooperation would have been able to meet the demands on time. Various measurement tasks in different plant areas had to be mastered:

- Fluid handling at raw milk reception and during cheese milk preparation
- Monitoring CIP processes
- Controlling wastewater discharge

Among others, it was specified that the process instrumentation be manufactured using EC 1935/2004 regulation-compliant material as well as industry-specific hygienic connections. For digital communication with the PLC, it was mandatory that most of the instrumentation have PROFIBUS® DP capability.



3. KROHNE solution

KROHNE was selected as the main instrument vendor to equip various production and auxiliary processes with flowmeters, level transmitters and analytical sensors.

The well thought-out project concept from consultation, to instrumentation, to integration, service and on-site support tipped the scales in KROHNE's favour. The following key applications were the focus of attention:

3.1 Raw milk reception

In order to determine the amount of raw milk delivered by road tankers, the raw milk reception docks were equipped with OPTIFLUX 6300 electromagnetic flow meters (EMF). Given the outdoor environment, the devices were completely fitted with insulation to guarantee a stable milk temperature at the measuring point.



Flow measurement at the raw milk reception with the OPTIFLUX 6300

3.2 Cheese milk preparation

Before the raw milk can be fed into the production line, it has to be prepared accordingly. This includes separation, standardisation and pasteurisation.

Separation:

In a first step, the delivered raw milk is separated into skimmed milk and fat. In order to accurately monitor the flows, OPTIMASS 7300 C Coriolis mass flowmeters were installed after the separators.

Standardisation:

Subsequently, the cheese milk is produced, i.e. the skimmed milk is standardised to the desired fat content according to the selected cheese recipe. This involves accurate dosing of large quantities of skimmed and full cream milk.

- KROHNE supplied two OPTIMASS 2300 for the dosing system. The twin straight tube Coriolis mass flowmeters in stainless steel were installed with aseptic flange connections (DIN 11864-2) into the vertical dosing lines before the tanks.
- An OPTIFLUX 6300 EMF was mounted after the dosing system to control the cheese milk transported to the milk pasteuriser.

Pasteurisation:

In the flash pasteuriser the cheese milk is gently treated to extend its shelf life. During this process, hot water is circulated at a regulated temperature using a system of plate heat exchangers and steam, while maintaining a constant temperature. In the heating section the cheese milk is heated in a counterflow and brought to pasteurisation temperature:

- The pasteuriser is equipped with OPTIFLUX 6300 to control the amount of cheese milk flowing through the system.
- In order to keep the ionic concentration in the condensate below a certain limit, the conductivity in the supply circuits is measured by OPTISENS COND 1200 conductive conductivity sensors. The sensors were installed into the condensate reflux and supplied with a MAC 100 signal converter.



Milk standardisation with the OPTIMASS 2300 C



Milk pasteurisation with the OPTIFLUX 6300 C



Conductivity measurement with the OPTISENS COND 1200 and MAC100 signal converter

3.3 CIP systems

To ensure plant and product safety and to comply with regulations, the dairy operates a comprehensive cleaning system of storage tanks, dosing stations and CIP lines. Each area requires consistent monitoring.

Among others, KROHNE

- equipped the tanks storing the concentrated agents with OPTIFLEX 2200 C level transmitters to ensure a reliable stock management
- supplied very small OPTIFLUX 6300 units enabling precise dosing of the caustic cleaning agents into the CIP circuits
- provided numerous EMF OPTIFLUX 6300 units for the CIP lines to allow for reliable monitoring and control of the CIP processes.



Process instrumentation for the CIP (Clean in Place) system: Stock management with the OPTIFLEX 2200 level transmitter (top and centre left). Dosing of CIP agents (bottom) and flow measurement of the CIP lines (top/centre right).

3.4 Wastewater management

In cooperation with an adjacent milk processing company, Royal-Aware operates a facility to treat dairy wastewater from cheese production. Before the effluent is discharged into the treatment facility, it has to be continuously monitored in terms of quality and quantity. KROHNE supplied the corresponding flowmeters as well as analytical instruments:



Flow measurement of dairy wastewater with the OPTIFLUX 2100 F



pH measurement of effluent with the SMARTPAT pH 8150

- In order to control the pH value in the effluent, the pH sensor SMARTPAT pH 8150 is used. The sensor was installed into the vertical effluent pipe. Due to its integrated transmitter, there was no need for an external transmitter as the sensor is directly connected to the control room.
- The volume flow of dairy wastewater is monitored by the electromagnetic flowmeter OPTIFLUX 2100 W. With its rugged, chemically resistant liner, the meter is particularly suitable for this application.

4. Customer benefits

The KROHNE devices ensure a high level of automation of the customer's most important processes – from raw milk reception to wastewater discharge. All specifications of the customer were considered and supplied as requested, helping Royal-Aware start production on time.

Royal-Aware benefits from the single source supplier KROHNE. Having only one contact person for on-site support and service, make it much easier for the customer to quickly resolve application related issues in the future.

Key to success was the well thought-out project concept and the close cooperation (across companies and countries) between KROHNE as the full service provider for measuring technology, Royal-Aware as the end customer as well as various contractors.

This complex project once again added to KROHNE's large application expertise and years of experience in the food and beverage industry.

5. Products used

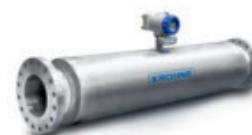
OPTIFLUX 6300 C

- Electromagnetic flowmeter for the hygienic measurement of raw milk and other conductive dairy products as well as CIP agents
- DN2.5...150 / 1/10...6", EHEDG and 3A certified



OPTIMASS 2300 C

- Twin straight tube Coriolis mass flowmeter for high volume measurement of milk and other dairy products
- DN100 / 4", EHEDG and 3A certified



OPTIMASS 7300 C

- Single straight tube Coriolis mass flowmeter for milk separation and standardisation
- DN10...100 / 1/2...4", EHEDG and 3A certified



OPTISENS COND 1200 and MAC 100

- Conductive conductivity sensor for monitoring condensate reflux to increase flash pasteuriser safety
- G1/2, G3/4, G1, NPT 3/4 (male); 0...20000 µS/cm



OPTIFLEX 2200 C/F

- Guided radar (TDR) level transmitter for stock management of CIP agents
- 0.6...40 m / 2...131 ft, independent from physical property variations



SMARTPAT pH 8150

- pH sensor for measurement of dairy wastewater
- PG13.5; with integrated transmitter



OPTIFLUX 2100 W

- Electromagnetic flowmeter for dairy wastewater applications
- DN25...1200 / 1...48", with rugged and chemically resistant liner



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APPLICATION REPORT

Food & Beverage

Level measurement of raw milk

- Improved stock management at the raw milk reception
- Minimised maintenance and product loss
- Hygienic level measurement using non-contact radar with PEEK antenna



1. Background

Latteria Soresina is one of Italy's largest and oldest manufacturers of dairy goods. The long-established company produces and distributes milk, butter, cream, whey and typical Italian cheeses including Latteria Soresina's renowned Grana Padano. The dairy operates four production sites in the Lombardy region that only process high quality milk produced by a selected group of farmers close to the production facilities.

2. Measurement requirements

The dairy was looking for improved stock inventory at one of their plants. This involved continuous level measurement of raw milk stored in outdoor tanks before processing. In the past, Latteria Soresina used hydrostatic pressure transmitters to measure the raw milk level. However, this contact technology often required expensive and time-consuming maintenance. In addition, the customer experienced accuracy drift and reliability issues. The customer therefore desired an alternative level solution on their milk tanks.

The vertical stainless steel tanks are 10 m / 32.8 ft height with a capacity of 100,000 litres / 26471.2 US gallons. They have lateral agitators to stir the milk which is kept at +4 °C / +39.2 °F by tank insulation. The tanks are filled and emptied from the bottom as well as CIP cleaned and sterilised from time to time using caustic soda and nitric acid at +70 °C / +158 °F.

Medium:	Raw milk
Measuring range:	0...10 m / 32.8 ft
Dielectric constant:	$\epsilon_r = \text{ca. } 80$
Viscosity:	ca. 1 cP
Density:	1.03 kg / l / 64.3 lb/ft ³
Pressure:	Atm
Temperature:	4 °C / 39.2 °F

The new level transmitter must comply with the stringent hygienic and quality requirements of the food and beverage industry regarding material and process connections too. Given the environment of the outdoor installation, a high degree of ingress protection (IP67) was also compulsory.

KROHNE

3. KROHNE solution

Latteria Soresina decided in favour of KROHNE's 2-wire radar level transmitter OPTIWAVE 7300 C. The dairy preferred the non-contact FMCW radar technology to pulse radar technology from competitors as it provides a more stable measurement in agitated environments. The OPTIWAVE reliably measures the level of the raw milk in spite of the moving surface of the medium, and the presence of foam and tank inserts.

The OPTIWAVE 7300 C was supplied with hygienic, FDA compliant PEEK antenna. It has been mounted on a nozzle on top of the tank using a hygienic Tri-Clamp 2" process connection. The quick setup function enabled the dairy to easily configure and start-up the device.

For inventory purposes, all measurements are continuously transmitted to the control room as a current output signal (4...20 mA).



OPTIWAVE 7300 C with hygienic Tri-Clamp connection

4. Customer benefits

The OPTIWAVE 7300 C helps Latteria Soresina improve stock management at raw milk reception. This hygienic, non-contact solution has increased the reliability, accuracy and long-term stability of their level measurements. The OPTIWAVE 7300 C is a top mounted device that minimises the frequency of maintenance activities and associated product losses.

5. Product used

OPTIWAVE 7300 C

- 2-wire non-contact radar (FMCW) level transmitter perfectly suited to the requirements of the dairy industry
- Increased accuracy and reliability for the measurement of dairy liquids, pastes and slurries
- Hygienic design: FDA and EC 1935/2004 compliant and suitable for SIP/CIP
- Reduced maintenance costs
- Long service life and stable operation for optimal productivity
- Measuring distance up to 80 m / 260 ft at max +150 °C / +300 °F
- PACTware and DTMs included as standard
- Current (mA), optional 2nd current output, HART®



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APPLICATION REPORT Food & Beverage

Flow measurement of raw milk with a high air content

- Monitoring the volume of raw milk for balancing the milk yield
- Volume measurement of product flow with entrained gas
- Continuous and uninterrupted operation of the measuring point



1. Background

Frischli Milchwerke GmbH produces fresh and long-life dairy products for retailers, catering establishments and other large consumers at several locations in Germany. The privately-owned dairy also operates one of Europe's largest and most modern production sites for individual coffee cream portions in Eggenfelden, Germany, producing around 1 billion portions at this location annually.

2. Measurement requirements

The raw milk needed for production (max. 22,000 kg/h / 808 lbs/m) is fed through the raw milk reception via two pipelines (DN 50 / 2") to several buffer tanks. The milk is first stored in these buffer tanks and then further processed into coffee milk in several stages. In order to compare the milk yield with the amount of raw milk delivered, it is necessary to have an accurate measurement of the raw milk volume as possible. To determine the volume of raw milk, Frischli previously used two standard mass flowmeters. The measurements, however, were repeatedly affected by entrained gas in the raw milk caused during transportation. Due to low temperatures and the corresponding viscosity, the operation of a deaeration tank also could not fully eliminate the entrained air. A two-phase stream occurs due to the entrained air which affects the oscillation signal of the traditional measuring device, thereby causing inconsistent sensor amplitudes. As a result, the electronics of the devices used was regularly disrupted when searching for the natural resonant frequency of the measuring tube, causing significant measuring errors or "frozen" measured values taken during the last stable readings. The required transparency of the processed raw milk volume could therefore never permanently be established, and so Frischli decided to install a mass flowmeter which can also reliably measure media with gas entrainment.

KROHNE

3. KROHNE solution

KROHNE recommended the replacement of the old device with the OPTIMASS 6400 C. The Coriolis mass flowmeter was installed in the two raw milk lines in front of the buffer tank. In accordance with the legal requirements, it has a hygienic aseptic flange connection according to DIN 11864.

In contrast to other mass flowmeters available on the market, the OPTIMASS 6400 maintains operation over a wide range of gas fractions and complex flow conditions. Using the patented functionality of Entrained Gas Management (EGM™), the flowmeter maintains operation even with air entrainments of up to 100% in the raw milk.



Installation of the OPTIMASS 6400 in front of the buffer tank

4. Customer benefits

Frischli is very pleased with the OPTIMASS 6400. The problems of flow measurement caused by entrained gas have now been resolved and continuous monitoring of the raw milk volume is possible. Significant measurement distortions or even the failure of the measuring point no longer occur. The measuring point is maintained regardless of the gas content in the raw milk, and the customer can continue to work with stable measuring results.

Today, by using the KROHNE measuring device, Frischli benefits from greater transparency of the volume of raw milk delivered. The customer uses this knowledge to balance the raw milk yield. In this way, the dairy plant can always compare the coffee cream produced with the actual raw milk volume delivered and, if required, determine the optimization potential of operational processes.

5. Product used

OPTIMASS 6400 C

- Twin bent tube Coriolis mass flowmeter for liquids and gases
- Entrained Gas Management (EGM™): maintains operation with gas entrainment of up to 100%
- Communication: HART®, FOUNDATION™ Fieldbus, PROFIBUS® and Modbus
- Modular electronics concept



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APPLICATION REPORT Food & Beverage

Milk reception with entrained gas

- Reducing time and costs required for unloading aerated milk from road tankers
- Continuous and reliable flow measurement even in the event of 2-phase flow
- No more unplanned shutdowns caused by equipment failure



1. Background

Milk dairy Surlat originated from a group of farmers in the South of Chile in the late 90s. The company specialises in the production and delivery of high quality and rich natural products. Their dairy goods range from basic products such as milk, cream and butter to the latest innovations such as reduced-fat and lactose-free milk products.

2. Measurement requirements

Surlat receives fresh milk from the local dairy farms daily. The milk is delivered from the farms to the dairy processing plant via large road tankers. Each tanker is unloaded at a flow rate of approx. 80,000 kg/h and up to four tankers can be unloaded at the same time. During transportation foam is produced from the movement and vibration of the tankers. The foamy milk is then stored in a common buffer tank where it waits to be processed.

The company had previously used Coriolis mass flowmeters from another manufacturer to measure the milk quantities at the raw milk reception. However, when the milk had entrained gas due to the foam produced during transportation, these Coriolis meters would always struggle and sometimes go into start up mode, i.e. completely stop measuring. These interruptions hindered the process for several reasons: first, the unloading process got interrupted requiring personnel time and manual intervention to restart, which in turn increased unloading time and reduced efficiency; and secondly, the loss of measurement caused commercial disputes over the quantity of milk delivered.

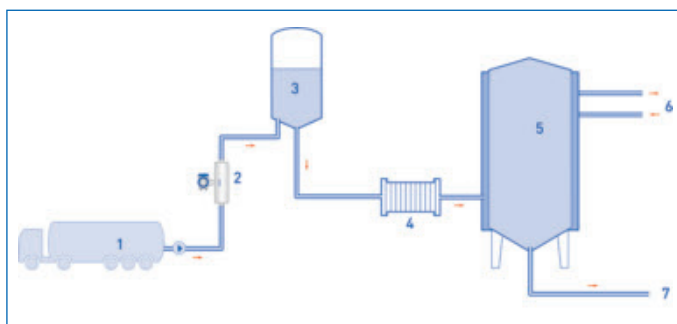
The milk processing plant therefore needed a flowmeter that measures raw milk mass flow, even during phases where entrained gas is present.



3. KROHNE solution

Surlat decided on the OPTIMASS 1400 C to check the ability to handle the raw milk reception with entrained gas. The twin straight tube flowmeter (DN50) was supplied in stainless steel and with hygienic Tri-Clamp connections.

Given its outstanding performance in the test installation, the KROHNE Coriolis mass flowmeter proved to be the right choice. When it comes to flow measurement of liquids with entrained gas, the OPTIMASS 1400 offers compelling advantages as compared to conventional Coriolis flowmeters like those previously installed. The KROHNE flowmeter features Entrained Gas Management (EGM™), providing reliable readings even in the event of gas entrainment in the foamy raw milk. In this way, the Coriolis meter enables continuous and uninterrupted measurement of volume flow and mass, density and temperature – even at difficult milk reception process conditions with 2-phase flow.



1 Road tanker; 2 OPTIMASS 1400; 3 Buffer tank; 4 Filter; 5 Cooled storage tank; 6 Cooling; 7 To separation and standardisation

4. Customer benefits

As the meter maintains operation over a wide range of gas volume fractions and complex flow conditions, the customer no longer has disruption to loading of the milk when entrained gas is present. The quantity measured is thus no longer disputed.

Using the highly accurate and repeatable KROHNE Coriolis mass flowmeter helped the dairy have a continuous measurement at the milk reception. The producer was able to calculate the milk yield and avoid the measurement interruption due to meter start up as was the case in previous Coriolis meters installed.

The dairy is very pleased with the performance of the KROHNE mass flowmeter. The customer decided that the OPTIMASS 1400 would become the default selection for this measurement. It is now the standard Coriolis meter for milk reception and will gradually be replacing other Coriolis meters installed for this application.



Flow measurement at raw milk reception with the OPTIMASS 1400

5. Product used

OPTIMASS 1400 C

- Coriolis mass flowmeter with twin straight tube design for universal hygienic applications
- Mass, density and volume flow of gases and liquids; maintains operation even with entrained gas of up to 100%
- Available with various hygienic connections (clamps, SMS, DIN 11851, etc.)
- 3A and EHEDG certified; conforms to FDA and EC1935/2004 regulations



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APPLICATION REPORT Food & Beverage

Mass flow measurement in the production of cottage cheese and spreadable cheese



- Dosage of ingredients
- Measurement of the quantity of the end product
- Consistent quality in the different cheese types

1. Background

Edelweiß, one of Germany's leading cheese producers, produces a wide variety of premium brand cottage cheese and spreadable cheeses. Depending on the final product, the base products vary, including milk and vegetable oil as well as various other ingredients but they must all be precisely dosed to ensure consistent quality. In addition to monitoring the dosing of the ingredients, the producer also monitors the overall yield of cheese from the raw milk product.

Years ago, cheese producer Edelweiß made the decision to replace all measuring devices with CORIOLIS mass flowmeters because these meters measure with higher accuracy and repeatability, thus ensuring the consistent quality of the end products. Measurement properties such as electrical conductivity and viscosity have no influence on the measuring accuracy.

2. Measurement requirements

Besides milk, vegetable oil is the second major base material in cottage cheese production. Vegetable oil is highly viscous and is not electrically conductive. To ensure that the oil can flow freely, the pipelines are heated to prevent blockages when flow velocities are low. The quantity of oil used is measured directly at the outlets of the storage tanks. Solids and entrained gas must not influence the measurements. In addition, the devices must be suitable for use with foodstuffs and have the appropriate approvals.

3. KROHNE solution

KROHNE supplied the cheese producer Edelweiß with OPTIMASS 7300 C mass flowmeters in a variety of sizes for these applications.

The single tube technology which features no flow splitters or built-in components in the measuring tube keeps any additional pressure loss to a bare minimum.

There are no special requirements when it comes to installing the meters in the pipelines and there is also no need for the otherwise commonly used inlet and outlet sections.

As they are a component of the pipelines, the straight tube meters are easily cleaned by way of CIP and SIP. The meters are maintenance-free.



Measurement of finished end product prior to filling

4. Customer benefits

For creameries and cheese dairies, OPTIMASS mass flowmeters from KROHNE offer many advantages including low investment and follow-up costs.

Excellent accuracy and repeatability ensure exact measuring results and thus consistent quality in the different types of cottage and spreadable cheese.

OPTIMASS 7300 C measuring devices can measure temperature and density in addition to the mass flow, which is important with changing process parameters. This enables different products to be processed one after the other using the same measuring device.



Measurement of vegetable oil

5. Product used

OPTIMASS 7300 C

- The only mass flowmeter with a single straight measuring tube available in Stainless Steel, Hastelloy®, Titanium or Tantalum
- Minimal pressure loss
- Reliable measurement of mass and volume flow, density, temperature, concentration and solid content
- No installation restrictions, easily drained and easy to clean
- High measuring accuracy, even when process conditions change
- Available with all the hygienic connections common to the food industry



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APPLICATION NOTE Food & Beverage

Measuring massflow and density in milk loading

- Loading excess milk onto milk lorries
- Determining the milk quantity and the separation point between water and milk
- Precise and cost-effective alternative to weigh bridges

1. Background

A French Cheese dairy periodically adapts their milk stocks to demand changes. If production has to be reduced, the cheese producer clears their stock quantity of milk by selling it to the market. For this purpose, the milk is directly loaded onto milk lorries (tank trucks) for delivery. During the loading procedure the milk is pushed through the line using water.

2. Measurement requirements

In order to measure the milk quantity as accurately as possible, the cheese dairy was looking for a suitable measurement solution that was also able to precisely determine the density of the milk loaded (1025...1040 kg/m³ / 64...65 lb/ft³). In this way, the separation point between water and milk could be identified so as to ensure only milk was loaded onto the trucks. The cheese dairy considered using either a weigh bridge or a flowmeter complying with their hygienic requirements.



Milk lorry

3. KROHNE Solution

The customer decided in favor of the OPTIMASS 7300 C Coriolis mass flowmeter. The meter allows for continuous measurement of mass flow and density. Once the specified quantity of milk has been reached, the filling process stops automatically. The switch-off point between milk and water is determined by the integrated density measurement. The OPTIMASS 7300 is a single straight tube meter and is manufactured in accordance with the requirements of the food and beverage industry. It is easily drained and cleaned using CIP/SIP.



Recording of the delivered quantity

4. Customer benefits

Using the OPTIMASS 7300 the cheese dairy benefits from significantly more accurate and reliable measurement of the milk quantities. The integrated density measurement enables the customer to control the milk loading process automatically and without water entering the trucks. The maintenance-free mass flowmeter from KROHNE also offers the customer substantial financial advantages when compared to a weigh bridge which would have caused much higher installation and operating costs.

5. Product used

OPTIMASS 7300 C

- Coriolis mass flowmeter for the accurate measurement of mass and volume flow, density, temperature, concentration and liquids with solid content
- Straight tube without constriction
- Supports a wide range of industry standard hygienic connections
- For demanding applications
- Easily drained and easy to clean, irrespective of the type of construction and process influences
- Excellent zero stability
- Rapid signal processing, even with product and temperature changes
- Modular electronics with data redundancy – "plug & play" replacement of electronics



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APPLICATION REPORT Food & Beverage

Equipping a mixing plant with flow and level measuring technology in the beverage industry

- Measuring volume and mass flow as well as level in storage tanks
- Dosing of all ingredients for consistent beverage quality
- All measuring devices from one source for simplified installation and operation



1. Background

Beverage producer Topochico Soft Drinks in Monterrey, Mexico, produces table water, soft drinks and wine mixers (sangria) for both the domestic market and export.

When equipping a new mixing plant, Topochico wanted to find a measuring device manufacturer able to provide all of the devices required. The number of measuring device manufacturers was to be reduced, obtaining everything for flow, mass, level, temperature and pressure measuring points from one source.

If possible, the measuring devices were also to feature an additional function, enabling them to measure quality parameters as well as perform the actual measuring task. Further, the devices had to be available with the desired pipeline connections.

Topochico also required a contact person for on-site support.

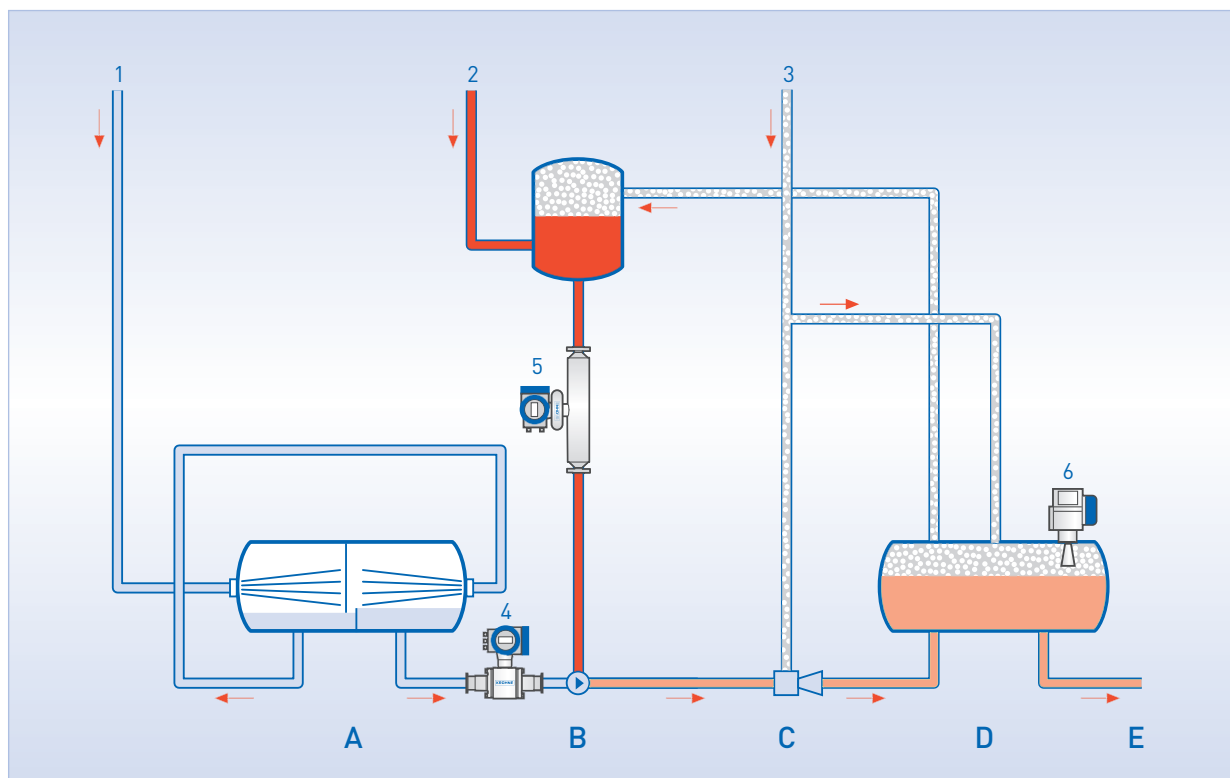
The reduction in measuring device suppliers is advantageous for equipment manufacturers and beverage producers. Purchasing processes are simplified as the purchase volume per supplier increases and it is easier to communicate with just one contact person.

Moreover, installation and follow-up costs are reduced because the mechanical and electrical installation for the various measuring devices is identical or at least similar. Further, the devices can be adjusted and operated via standardised concepts. Maintenance and the procurement of spare parts follow the same process.

2. Measurement requirements

The measuring devices used should be made of FDA-compliant materials and comply with all hygienic requirements including 3A approvals. The compact measuring devices should be able to be easily cleaned with CIP/SIP and it goes without saying that the devices should be available with all of the common hygienic connections.

Principal configuration of a mixing plant for soft drinks and the typical measuring tasks



Production steps

- A Degassing of the make-up water
- B Mixing pump
- C Carbonation
- D Storage tank with finished beverage
- E To the filling plant

Components introduced

- 1 Water
- 2 Syrup concentrate
- 3 CO₂

Measurements used

- 4 Volume flow
- 5 Mass flow
- 6 Level

Mass flow measurement of the syrup concentrate

Measuring the various kinds of syrup is the most important flow measurement in a mixing plant. On the one hand, syrup is the most expensive beverage component used in production. On the other hand, the syrup contributes significantly to the quality of the end product. The mass flow measurement may not allow itself to be affected by changes in process conditions. In addition, it should be possible to determine the quality parameters by measuring the syrup concentration in °Brix. Minimal additional pressure loss and the capacity for easy drainage were other very important requirements for the mass flowmeters.

Volume flow measurement of make-up water

The product properties of make-up water may vary depending on the origin and intended use. The most important parameter is the electrical conductivity of at least 20 $\mu\text{S}/\text{cm}$ ($\mu\text{mhos}/\text{cm}$). This value was not to affect the devices available for selection for volume flow measurement. In addition, it had to be possible to assess the quality of the make-up water via a conductivity measurement.

Non-contact measurement of the beverages ready to be filled

Topochico was searching for absolutely reliable and accurate level and volume measurement for the ready-to-fill end products in the storage tanks. They required the continuous measurement of the volume in the tank in real time.

3. KROHNE solution

KROHNE supplied Topochico with the following measuring devices for this application:
4 OPTIMASS 1300 C mass flowmeters to measure the syrup
4 OPTIFLUX 6300 C electromagnetic flowmeters to measure the make-up water
6 OPTIWAVE 7300 C radar level meters to measure the end products in the storage tanks

OPTIMASS 1300 C mass flow measurement of the syrup concentrate



In addition to measuring the flow of the various kinds of syrup, the OPTIMASS 1300 C also measures the syrup concentration in °Brix for quality assurance. The device is easily drained, which is important when there are frequent product changeovers. The measuring section features two parallel, straight stainless steel pipes with flow splitters. The mixing ratio of water to syrup can be accurately set prior to dosing. Diluted syrup phases which may occur during product changeovers can now be almost completely utilised. This reduces syrup loss. Due to the minimal loss of pressure, a smaller nominal size than that of the process line could be used for these devices. The device can be cleaned via CIP / SIP and is approved according to 3A.

OPTIFLUX 6300 C electromagnetic measurement of the make-up water



OPTIFLUX 6300 C can be used for water starting at an electrical conductivity of 20 $\mu\text{S}/\text{cm}$ ($\mu\text{mhos}/\text{cm}$). Thanks to the integrated conductivity measurement, Topochico no longer has a need for separate measurement. The measured conductivity is transmitted via a 4...20 mA current output (alternatively via Bus) to the in-house laboratory. In addition to this measurement, the device also features application and device diagnostics to help the user operate the devices optimally and thus achieve the superior plant availability. OPTIFLUX 6300 C is available in sizes DN 2.5...150 / 1/10" ...5" with all of the industry-specific hygienic connections. The maximum operating temperature is 140 °C / 284 °F. The devices feature FDA-compliant materials and are certified to 3A.

OPTIWAVE 7300 C Level measurement of finished products (FMCW radar)



The volume contained in the tank is continuously measured and displayed (in real time) by the OPTIWAVE 7300 C. The OPTIWAVE 7300 C radar level meter was especially designed for liquid products and works according to the non-contact FMCW principle (Frequency Modulated Continuous Wave).

The continuous measurement provides stable measured values and is ideally suited to moving process conditions such as agitated surfaces. The device can measure the distance, level and volume in the tanks.

4. Customer benefits

The high demands placed by Topochico on the measuring devices used were met and even exceeded in all areas. The deciding factor for Topochico was that KROHNE offered a selection of measuring devices to equip a mixing plant for flow, level, temperature and pressure measurement in a variety of versions and qualities. The devices have 3A approval and conform to the FDA, as required. Further, all devices are available with different hygienic connections. The fact that this was all available from one source, added to KROHNE's years of experience in the industry, tipped the scales in KROHNE's favour as a supplier. Previously, special custom-made devices had been necessary for many applications in the food and beverage industry. Now, standard measuring devices cover these needs.

5. Products used

OPTIMASS 1300 C

- Coriolis mass flowmeter for accurate measurement of mass flow, density, volume, temperature, volume concentration or solid content
- Innovative twin measuring tubes
- Self draining and easy to clean
- Unaffected by type of installation and process effects
- Various hygienic process connections available (DN 25...80 / 1...3")
- Optimised flow divider for minimum pressure loss
- Modular electronics concept with data redundancy
- Available as compact or remote version



OPTIFLUX 6300 C

- Electromagnetic flowmeter developed in cooperation with customers from the food industry
- Stainless steel version for all hygienic uses
- Unique seal concept
- Suitable for CIP / SIP processes
- All industry-specific connectors and lengths
- Available in compact and remote versions
- Sizes DN 2.5...150, corresponding to 1/10" ...6"
- High form stability and vacuum resistance



OPTIWAVE 7300 C

- FMCW non-contact radar level meter for liquids
- Reliable measurement in difficult process conditions even in tanks with agitated surfaces, foam or internal objects
- Hygienic antenna for processes where stringent hygiene standards must be obeyed
- Hygienic flange versions available: BioControl®, Tri-Clamp®, DIN 11851 (DN 50 / 2"); SMS 51; others on request
- Operating condition for the hygienic antenna option: -20...+150 °C / -4...+300 °F
- Measuring range up to 80 m / 260 ft
- PACTware and DTMs are included by default



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APPLICATION NOTE Food & Beverage

Determining flow and Brix in the production of fruit juices

- Mass flow measurement for dosing additives
- Concentration measurement to determine sugar content
- Automated control for consistent product quality

1. Background

A European food manufacturer produces fruit juices (including pears, apricots and peaches). Besides fruit juice concentrate, vitamins and other additives are added to the mixing tanks during production. The correct dosage of each respective medium is very important in this process step. Water is added afterwards, depending on the sugar content (Brix value). The finished product is then stored in buffer tanks.



Fruit juices

2. Measurement requirements

The customer was looking for an appropriate measurement solution to monitor the dosing process and continuously determine the Brix value in the concentrate. As the media to be measured are slightly viscous, it was essential that the instrumentation had no constrictions or bends and that it caused only very little pressure loss.

3. KROHNE solution

The fruit juice producer decided to use several OPTIMASS 7300 mass flowmeters. These devices determine the mass and volume flow of additives that are added to the fruit juice concentrate. In addition, the KROHNE device also uses the integrated density measurement to calculate the sugar concentration in the fruit juice concentrate. As the OPTIMASS 7300 is a single straight tube device, flow measurement with a free cross-section is always guaranteed. This enables measurement with virtually no pressure loss.

4. Customer benefits

The OPTIMASS 7300 makes it possible for the fruit juice producer to properly dose all of the ingredients. At the same time, thanks to the Brix measurement, it is always possible to establish the right ratio of water to fruit juice concentrate and to adjust the sugar content in the finished product to the desired target value. Using the customer's PLC, the dosing and mixing processes can be automatically controlled. Consistently high product quality is thus guaranteed. The customer benefits from a mass flowmeter boasting best in class accuracy.



Brix measurement with the OPTIMASS 7300

5. Product used

OPTIMASS 7300 C

- Coriolis mass flowmeter to determine sugar content (Brix value) in juices and fruit juice concentrates
- Reliable measurement of mass and volume flow, density, temperature as well as liquids with solids content
- For hygienic applications requiring high performance
- One straight measuring tube: any installation position, self-draining, easy to clean, maintenance-free
- High degree of measuring accuracy even when process conditions change
- Certified to EHEDG and 3A
- Suitable for custody transfer (MID MI-005, OIML R117-1 etc.)



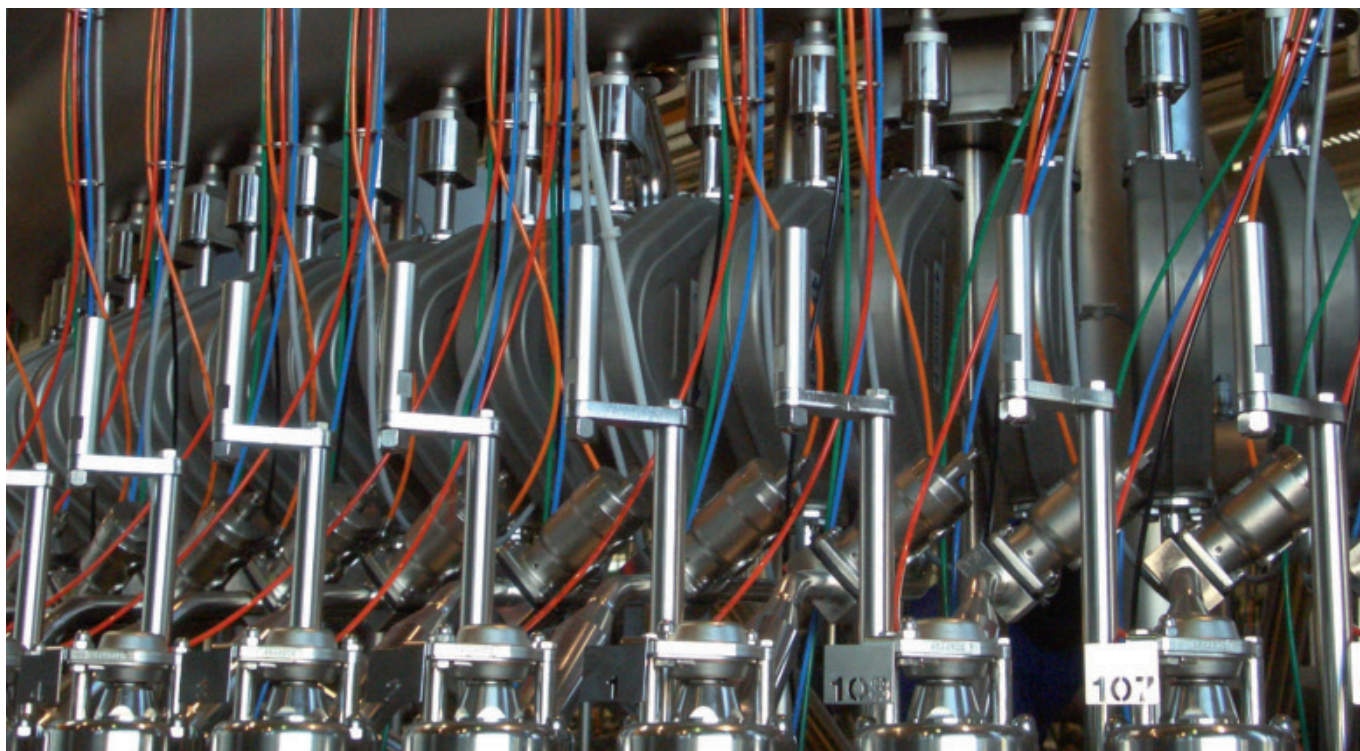
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APPLICATION REPORT

Food & Beverage

Equipping a filling machine with Coriolis mass flowmeters

- High filling accuracy at little or no conductivity
- Filling of both carbonated and still liquids with a single filling machine
- High level of repeatability, even in the case of variable quantities



1. Background

For precise control of the filling quantity, filling machines (rotary filling machines or linear filling machines) are equipped with flow measuring devices. Particularly when PET bottles, pouches and cans are filled with water, lemonade, tea and milk products, it is typically electromagnetic flowmeters that are used.

2. Measurement requirements

Krones AG, based in Neutraubling, Germany, designs, develops, manufactures and installs machines and complete systems for process, filling and packaging technology as well as intralogistics. Information technology and factory planning complete the company's product portfolio. The company won a contract from a soft drink producer for a rotary filling machine with 112 filling stations for the filling of different products in one filling line. In addition to carbonated products, it had to be able to fill still products as well. The meters used must not only have superior accuracy but also good repeatability (long-term stability).

3. KROHNE solution

As water from osmosis installations is increasingly used in place of well water in the production of beverages, the conductivity of the water is between 5 and 10 $\mu\text{S}/\text{cm}$ or $\mu\text{mohs}/\text{cm}$. As a result, the accuracy of the electromagnetic flowmeters deteriorates to such a degree that the standard accuracy of the complete filling system also becomes worse. Coriolis mass flowmeters can be used as an alternative to electromagnetic meters.

KROHNE

3. KROHNE solution

As water from osmosis installations is increasingly used in place of well water in the production of beverages, the conductivity of the water is between 5 and 10 $\mu\text{S}/\text{cm}$ or $\mu\text{mohs}/\text{cm}$. As a result, the accuracy of the electromagnetic flowmeters deteriorates to such a degree that the standard accuracy of the complete filling system also becomes worse. Coriolis mass flowmeters can be used as an alternative to electromagnetic meters. They measure regardless of viscosity, conductivity or inlet runs and can also determine precise volume or mass flow in extremely short filling times. Kronos decided to equip the filling stations with the OPTIBATCH 4011 C with the nominal size DN 15 / (approx.) $\frac{1}{2}$ ". The flowmeters were supplied with hygienic flange connections conforming to DIN 11864-2.

4. Customer benefits

Using Coriolis mass flowmeters makes it possible to fill different products with varying conductivities. OPTIBATCH 4011 C was specifically developed for use with filling machines and features superior accuracy through direct measurement as well as measurements that are stable over the long term. The filling processes can take place both with and without pressure. Depending on requirements, both carbonated and non-carbonated products can be filled using the meters. The mass pulses are transmitted directly from the OPTIBATCH 4011 C to the total control system via a multi-pole connector. A separate evaluation unit is not required. The entire electronics of the measuring device are integrated into a fully welded stainless steel housing. A PC-supported programme is used to record filling processes or adjust settings on the meters.



OPTIBATCH 4011 C on the filling machine (seen from the inside)

5. Product used

OPTIBATCH 4011 C

- Coriolis mass flowmeter, specifically designed for use with filling machines
- High measuring accuracy and repeatability, even with non-conducting and fatty liquids
- Compact dimensions, short installation length, low pressure loss
- A variety of hygienic connections available
- Fully welded stainless steel housing with integrated electronics
- Multi-pole connector to transmit mass and volume pulses
- Certified to 3A and EHEDG



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APPLICATION NOTE Food & Beverage

Equipping a soft drink factory with measuring instrumentation

- Flow and level measurement
- Safety control for dry-run prevention of pumps
- One single contact person from the project planning phase until start-up

1. Background

A French mineral well operator has opened a new production plant for lemonades and soft drinks. In addition to its own spring water, the company uses mainly syrup and CO₂ in production.

2. Measurement requirements

Measuring technology continuously monitors all parameters including flow and level, pressure and conductivity to ensure a smooth process flow and a high-quality end product.

It is mandatory for the devices used to meet the high requirements of the food and beverage industry. The measuring devices must feature suitable hygienic connections, be manufactured using food grade materials and be suitable for use in CIP cleaning.



OPTIFLUX 6300 electromagnetic flowmeter

3. KROHNE solution

KROHNE supplied all of the measuring instrumentation for this project. This includes, among other things:

- OPTISWITCH 6500 level switches used for level detection in the processing tanks and as dry-run protection for the pumps.
- OPTIFLUX 6300 electromagnetic flowmeters for liquid transport.
- OPTIMASS 7300 Coriolis mass flowmeters with titanium straight tubes for highly precise density and flow measurement of the syrup as well as for dosing and transporting products to the processing facilities.
- OPTISWIRL 4070 vortex flowmeters for carbonation, i.e. the injection of CO₂ during soft drink production.

KROHNE also supplied other devices such as conductivity sensors (for the CIP cleaning systems) and pressure transmitters (to measure the level in the processing tanks), all from the one source.



OPTISWITCH 6500 level switch

4. Customer benefits

As a result of all the devices coming from the one source, the customer benefits from maximum transparency in terms of both production and product quality. During the course of the project, KROHNE consulted extensively with the customer regarding the selection and design of the measuring technology. This included in particular: the technology used, the right sizing of the measuring devices, recommendations for installation, start-up and staff training. This way, the customer had the benefit of just one contact person from the project planning phase all the way through to start-up.

5. Products used

OPTISWITCH 6500

- Capacitance level switch for hygienic applications
- Ideal for point level detection and dry-run protection in the food and beverage industry
- Insensitive to scaling or foam
- No maintenance required



OPTIFLUX 6300

- Electromagnetic flowmeter for the food and beverage industry
- For demanding mixing, dosing and filling applications with liquids
- DN 2.5...150 / 1/10...6"; process temperature up to +140°C / +284°F (suitable for SIP/CIP)



OPTIMASS 7300

- Coriolis mass flowmeter for extremely demanding food applications
- Single straight tube design without flow splitter for minimal pressure loss
- DN10...100 / 1/2...4"; flow rates up to 560,000 kg/h / 20,567 lb/min
- Best in class for accuracy and zero stability



OPTISWIRL 4070

- Vortex flowmeter for liquids, gases and steam
- Integrated pressure and temperature compensation for auxiliary and supply circuits with changing process conditions
- Gross and net heat capacity calculation for hot water and steam
- Standardised measurement under real conditions



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APPLICATION NOTE Food & Beverage

Flow measurement for the cold sterilisation of juices and sparkling beverages

- Efficient DMDC dosing for cold sterilisation of fruit juice beverages
- Determining the beverage volume for proportional control of a dosing system
- Yield maximisation of a safe end product with a long shelf-life

1. Background

One of Germany's largest manufacturers of mineral water and beverages produces juice-based soft drinks such as sparkling apple juice. The beverages are preserved on site to protect the end products from things like bacteria, mould and yeast.

However, to avoid adversely affecting the taste and colour of the beverages, the company stays away from traditional methods such as pasteurisation and hot filling, opting for a state-of-the-art cold sterilisation process.

2. Measurement requirements

The manufacturer uses a highly effective microbial control substance for the cold sterilisation. This food additive, known as dimethyl dicarbonate (DMDC), is added to the end product in extremely small doses to deactivate the enzyme (carboxymethylation). Within a few hours the ester breaks down into negligible amounts of methanol and CO₂. Both are found naturally in many fruit and vegetable juices. Cold sterilisation is thus considered safe and does not pose any health risks.

A dosing unit doses the DMDC. A dosing pump is used to introduce the medium into the main product flow, which is subsequently transported to bottling. In order to set the desired ratio of DMDC to beverage volume and to adhere to the approved limits, the flowrate of the sparkling juice must be continuously and precisely measured.

3. KROHNE solution

To accurately determine the volume flow of the fruit juice beverages the customer installed the OPTIMASS 1400 C Coriolis mass flowmeter. Due to the twin straight tube design featuring an optimised flow splitter there is virtually no pressure loss and the flowmeter is self-draining and easy to clean. For this reason it is the perfect choice for hygienic applications.

Upon customer request the measuring device was made of stainless steel (1.4404) and fitted with aseptic pipe screw connection (DIN 11864-1A) in DN50. It has been installed in the standpipe, immediately before the ester is added using the dosing system. The converter on the Coriolis device is also made of stainless steel. In addition to information about volume flow, the device also provides the added volume as well as a contact output when a minimum density is not reached.



Measuring the flow of the beverage volume with the OPTIMASS 1400 C



Dosing system for cold sterilisation

4. Customer benefits

Using the OPTIMASS 1400, the customer can add the DMDC according to a proportional control. The KROHNE device thus fulfills an important role in maximising yield. Based on the beverage flow, only the amount of sterilisation agent that is actually necessary to sterilise a maximum beverage volume is added. This makes it possible to effectively prevent expensive overdosing. Limits are observed. The mass flowmeter thus contributes to the production of a safe end product with a long shelf-life and the beverage producer can guarantee the best possible product quality by using this cold sterilisation process to protect the flavour.

5. Product used

OPTIMASS 1400 C

- Coriolis mass flowmeter for universal applications and process control in the food and beverage industry
- Highly accurate measurement of volume flow, mass flow and density
- Entrained Gas Management (EGM™): continuous operation with no loss of measurement at up to 100% gas content in the medium
- Twin straight tube design made of stainless steel (EHEDG, 3A; EC1935/2004, FDA)
- Self-draining and easy to clean (CIP/SIP)
- Numerous hygienic connections: SMS, clamps, DIN 11864-1A, DIN 11851 etc.
- 3 x 4...20 mA, HART®7, Modbus, FF, Profibus-PA/DP, PROFINET



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APPLICATION NOTE Food & Beverage

Mass flow measurement for soft drink carbonation

- Repeatable and highly accurate dosing of CO₂ to increase yield
- Establishing a consistently high product quality of carbonized soft drinks
- Minimizing costs and product waste through efficient use of resources

1. Background

A manufacturer of soft drinks operates various beverage plants in South America. Next to bottling and distribution facilities, the company runs a mixing plant where some of their brands are blended and then finally carbonated.

2. Measurement requirements

The mixing plant has an inline blending system where water and syrup are carefully combined in a mixing station with proportioners that regulate the flow rates and ratios of the liquids. Having been mixed together, the finished products are transported to the carbonator. During the carbonation process, a desired quantity of CO₂ is injected into the process to give the soft drinks their sparkling character.

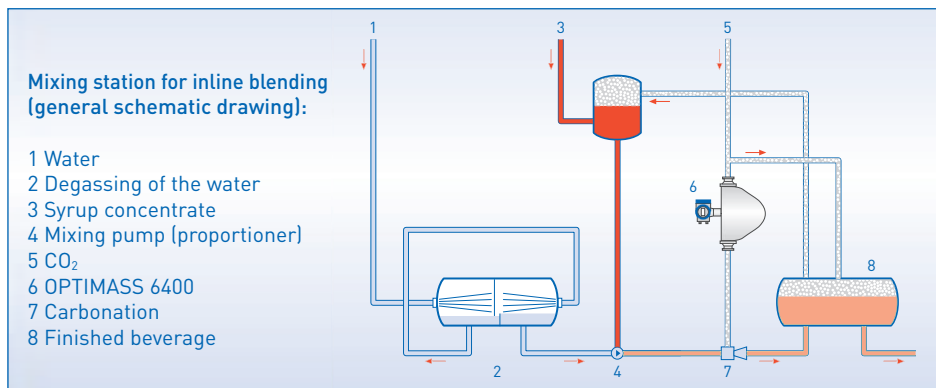
In order to run the carbonation process more efficiently and to improve the product yield of aerated soft drinks, the customer decided to update its dosing equipment. In the past, the customer had been supplied with CO₂ by a gas manufacturer and billed accordingly. The plant operator was therefore searching for a flowmeter that enabled a precise input control of CO₂ and provided transparency over the actual gas quantity consumed.

3. KROHNE solution

The customer decided on the OPTIMASS 6400 flowmeter. The Coriolis mass flowmeter is a standard measuring device for gas and liquid applications in the food and beverage industry. The KROHNE meter features a twin V-shaped measuring tube and a patented flow splitter that enables an optimised flow profile and minimizes pressure loss. It provides maximum measuring accuracy and repeatability ($\pm 0.35\%$ of measured value for gases).

The Coriolis mass flowmeter was supplied with stainless steel (316L) measuring tube. Hygienic process connections were not required as the CO₂ still passes a polisher system to remove impurities before it is dosed into the product stream. The KROHNE flowmeter was therefore mounted with standard flanges (DN50), though a wide range of clamp, SMS or other hygienic fittings would also have been available.

To prevent the build-up of condensation from influencing the measurement, the measuring device has been installed in a horizontal pipeline with the bent dual measuring tube above the longitudinal axis of the pipe (see image below right).



Installation of the flowmeter

4. Customer benefits

Using the OPTIMASS 6400 helps the beverage company maximize the soft drink yield. Due to the high accuracy and repeatability of the KROHNE meter, the customer is now able to inject as little CO₂ as necessary to carbonate as many soft drinks as possible. In turn, it also allows the customer to better meet the production quality criteria, enabling a consistently high product quality in terms of carbonation. In this way, the efficiency increase saves on product waste and costs for CO₂ resources.

5. Product used

OPTIMASS 6400 C

- Coriolis mass flowmeter for gases and liquids in the food and beverage industry
- Twin bent tube design with stainless steel (1.4404 / 316L) sensor material
- High accuracy mass, density and volume flow measurement ($\pm 0.35\%$ of MV for gases and up to $\pm 0.05\%$ of MV for liquids)
- Available with various hygienic connections (clamps, SMS, DIN 11851 etc.)
- Hygienic certifications and standards: 3A, EHEDG; FDA, EC 1935/2004
- Communication options: HART®, FOUNDATION™ Fieldbus, PROFIBUS® PA & DP, Modbus and PROFINET



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APPLICATION REPORT Food & Beverage

Monitoring water abstraction from deep wells

- Measuring water volumes for the production of mineral water and soft drinks
- Electromagnetic flow measurement in accordance with drinking water regulations
- Replacement of mechanical water meters with non-wearing measurement devices

1. Background

Harzer Mineralquelle Blankenburg GmbH is a medium-sized, owner-operated mineral well company in Germany. It sells high quality mineral waters as well as lemonade and other soft drinks. The mineral water used in these drinks comes from an underground water resource deep in the Harz mountains which is protected against contamination.

2. Measurement requirements

The company operates two deep wells for water abstraction. The amount of deep water abstracted using the on-site well must be continuously measured and recorded in accordance with the water permit issued by the local water authority. The mineral water producer used to use two mechanical water meters to determine the volume flow. These suffered continuous wear and tear because of the mechanics inside the measuring tube. These turbine flowmeters regularly got clogged with dirt and sludge particles. This meant that the customer had to keep replacing the instruments, thereby incurring high investment and installation costs.

Medium:	Deep water
Flow rate:	15 m ³ /h / 529 ft ³ /h
Density:	1 kg/l / 8.34 lb/gal (US)
Temperature:	+10°C / +50°F

Harzer Mineralquelle therefore decided to replace the water meters with non-mechanical, non-wearing flowmeters, which do not require built-in components and moving parts. The necessary measuring instruments had to be certified for drinking water use as per DVGW (German Technical and Scientific Association for Gas and Water) and meet the requirements of the "Guideline for the hygienic assessment of organic materials in contact with drinking water" (KTW guideline) issued by the German Environmental Agency.



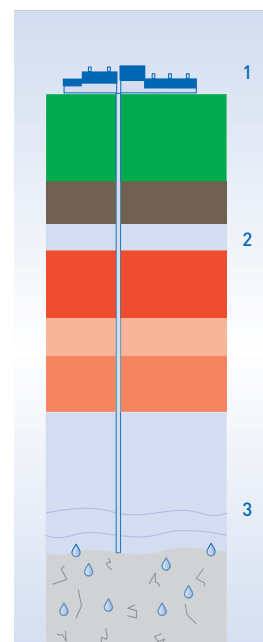
3. KROHNE solution

Based on the professional advice and the excellent price-performance ratio, the customer opted for the WATERFLUX 3100 C electromagnetic flowmeter (EMF). One device was fitted in each of the two deep well pipes with a nominal size of DN 50. The fact that these stainless steel pipes are reduced just before the measuring point does not affect the measurement. The measuring instrument does not require a straight inlet or outlet and can, therefore, be installed directly behind an elbow or reducer.

The WATERFLUX 3100 has a patented rectangular and reduced pipe cross section which optimises the average flow velocity and the flow profile. The installation conditions are, therefore, virtually irrelevant for this measuring device, unlike conventional EMFs. The non-wearing construction with Rilsan® liner means that the measurement device is impervious to solid contents in the well water. The WATERFLUX 3100 holds the required drinking water approvals as per DVGW and KTW.



Water flow measurement with the WATERFLUX 3100 C



Deep water abstraction of the mineral spring:
1 Well operation,
2 Ground water,
3 Deep water

4. Customer benefits

Harzer Mineralquelle now benefits from a non-wearing and maintenance-free measuring device. Unlike mechanical water meters, the WATERFLUX 3100 is durable and does not need constant cleaning or regular replacement. This guarantees the company major cost savings. The risk of process disruption due to faulty measuring devices is now minimal.

5. Product used

WATERFLUX 3100 C

- Electromagnetic flowmeter for water applications
- Unique design with rectangular and reduced cross section
- Excellent measuring performance even at low flow rate, regardless of flow profile
- Nominal sizes: DN 25...600 / 1...24"
- Cost-effective installation with reference electrodes, no grounding rings required
- No inlets or outlets necessary for installation in confined spaces
- Reliable and maintenance-free: no moving parts, no wear, no deposits
- Measuring tube with chemical-resistant Rilsan® coating
- Drinking water approvals including ACS, DVGW, NSF, TZW, KTW and WRAS
- HART®, FOUNDATION fieldbus, Profibus® PA and DP, Modbus
- In-situ verification of measuring device with OPTICHECK



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APPLICATION REPORT Food & Beverage

Flow measurement for the filling of fruit preparations

- Highly accurate product filling into special containers for customer delivery
- Mass flow measurement of fruit products with whole fruit chunks
- Addition of hanging scales to automate the filling process with PROFIBUS® DP



1. Background

Zentis GmbH & Co. KG is one of Europe's largest fruit processing companies with over 2000 employees around the world. The company's product range includes fruit preparations and raw mixtures for the dairy and baking industries as well as jams and desserts for the retail sector. Zentis produces around 200,000 t of fruit products per year at the main factory in Aachen, Germany, alone. The products are then delivered to milk processing plants as additions to quark and yoghurt products.

2. Measurement requirements

The products are delivered in special transport containers. Depending on the order, the containers have different capacities of 1000, 500 or 250 kg (approx. 2205, 1102 or 551 lb). The containers must be filled differently according to weight and customer specifications. To guarantee this, Zentis relies on the highly accurate filling of its fruit preparations.

Up until now the customer has been using a hanging scale for filling. The filling process was thus costly and prone to error. As the supply line must always be connected to the container when filling, this measuring process always runs the risk that the weight of the line is added to the scale. The customer decided to replace the hanging scale with a flowmeter in order to minimise the risk of error and automate the filling process using a control unit. The purpose of the flowmeter is to directly measure the mass of the lightly viscous product full of chunks of fruit. The pipe geometry of the measuring device had to be such that the fruits in the product flow could not be destroyed. In addition, the pressure loss resulting from the use of the measuring instrument should be kept to a minimum.

Measuring parameters	
Medium:	Fruit preparation
Measuring range:	30...600 kg/min / 66...1323 lb/min
Minimum measured quantity:	200 kg / 441 lb
Temperature:	+25 °C / +77 °F
Pressure:	1.5 bar abs / 21.75 psia
Density:	1.2 kg/m ³ / 2.02 lb/yd ³
Viscosity:	500 mPas



3. KROHNE solution

Due to the measuring parameters, a Coriolis mass flowmeter without flow splitter was the instrument of choice for this application. The OPTIMASS 7300 W fulfills this requirement and impressed the customer with its superior accuracy. The mass flowmeter has a single straight measuring tube particularly well suited to measuring product flow containing chunks of fruit without causing great pressure loss in the process.

Zentis installed two OPTIMASS 7300 units in the hygienic stainless steel version (DN50) and with industry specific threaded connection (as per DIN 11851) into the filling line in front of the containers. A pump now pumps the fruit preparation from the production tank, through the measuring device into the special containers. The OPTIMASS 7300 communicates with the filling system via its PROFIBUS® DP interface.



Flow measurement of fruit preparations with the OPTIMASS 7300 W

4. Customer benefits

The OPTIMASS 7300 W makes it possible to precisely control the automated filling of the containers. The mass flowmeter measures with a high degree of accuracy and independent of any changes in viscosity or solid-type fruit chunks in the medium.

Its single straight measuring tube design means that it can be installed in confined spaces, is self-draining and easy to clean.

The OPTIMASS 7300 W measuring results are continuously calculated in the transport line and made available in the control room. If necessary, Zentis could also transfer other parameters such as volume and density, which the mass flowmeter also measures directly, via the PROFIBUS® interface into the control room.

5. Product used

OPTIMASS 7300 W

- Coriolis mass flowmeter for extremely demanding food applications
- Single straight tube design without flow splitter for minimal pressure loss
- DN10...100 / ½...4"; flow rates up to 560,000 kg/h / 20,576 lb/min
- Best in class for accuracy and zero stability
- Measuring tubes available in 4 materials (stainless steel, titanium, Hastelloy®, tantalum)
- Modular electronics concept
- Optional heating jacket
- EHEDG, 3A, FDA, EC 1935/2004
- HART®, FOUNDATION™ fieldbus, PROFIBUS® PA and DP etc.



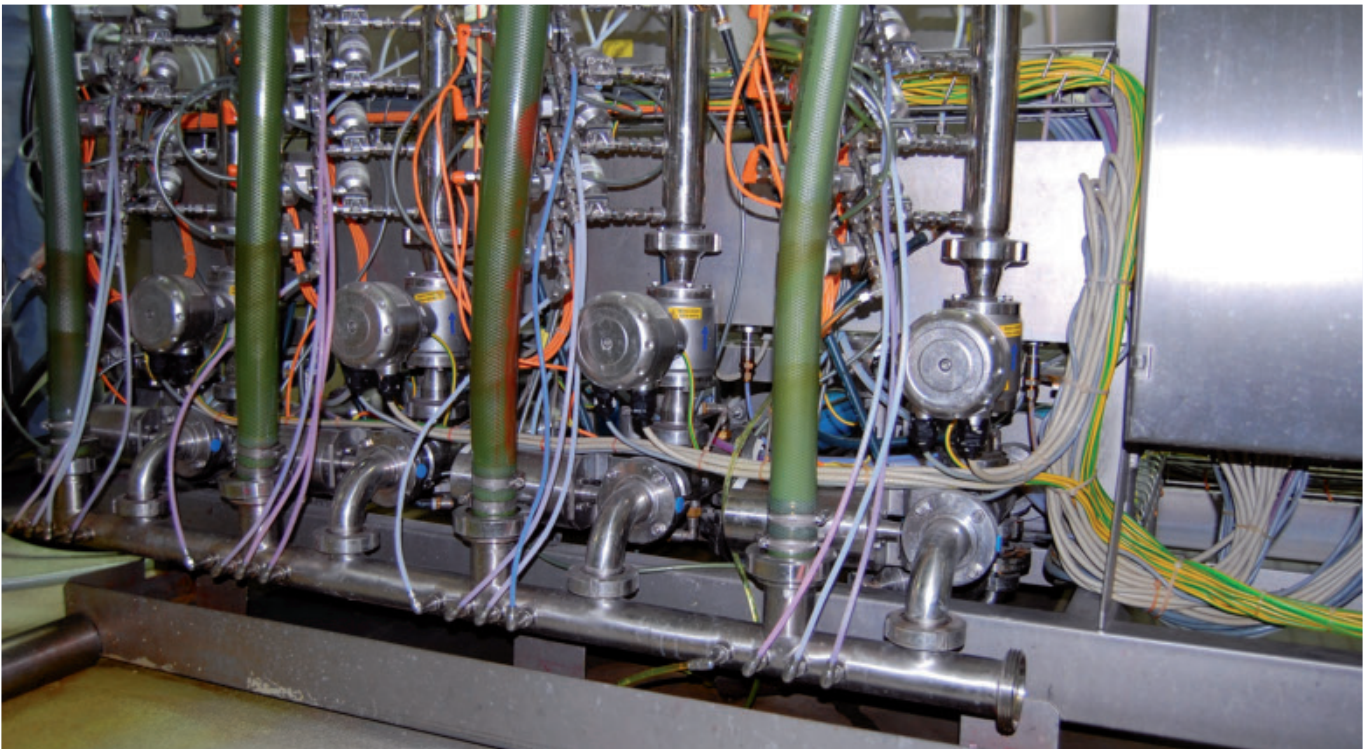
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APPLICATION REPORT Food & Beverage

Inline aromatisation of foam in the manufacture of confectionery

- Continuous inline dosing of flavour and colouring to foam base mass
- Stable composition of the product
- High level of repeatability, even in the case of fluctuating consumption



1. Background

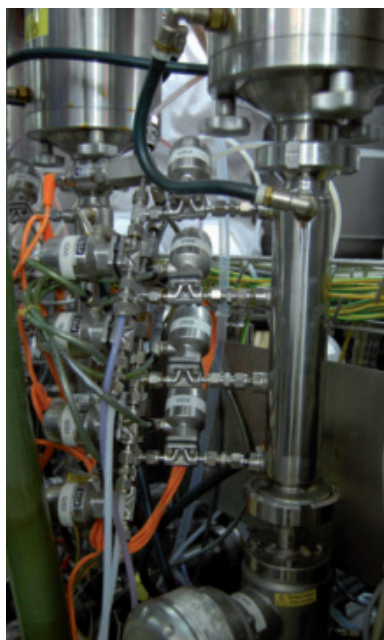
As well as licorice, products made from fruit gum, such as jelly babies, are firm favourites in sweet shops. Depending on the type however, such sweets either contain sweet foam or even are made entirely of sweet foam. This is the case with many of the products from the MEDERER Süßwarenvertriebs GmbH Company in Fürth, which markets its products under the brandname Trolli. The sweets can consist of several layers where typically, the lower layer is made of foam and the top one of fruit gum. One example of this is the well know "Sour apple rings" from Trolli.

2. Measurement requirements

To start with, the fresh foam is produced in a special mix machine and then aerated. Following this, the foam is given its taste and colour through the inline dosing of additives. Then, the foam leaves the machine and is formed into the required shapes, e. g. bears, frogs or rings in the so-called Mogul machine, by being dosed into starch filled mould boards.

3. KROHNE solution

In order for the foam to have the required flavouring and colouring, various flowmeters have been deployed on each line. An electromagnetic flowmeter OPTIFLUX 6000 (DN 25 / 1") measures the volume flow of the fresh, still tasteless foam as it comes out of the mix machine. At the same time, various additives, namely the colouring, citric acid and aromas are metered in.



Three of these products are measured using an OPTIFLUX 6000 with smaller diameters (DN 2.5 / 1/10" and DN 4 / 1/8"). One medium does not have sufficient conductivity and for that reason is measured using a small Coriolis mass flowmeter OPTIMASS 3000 (DN 3).



Measurement of the metered flavours using OPTIFLUX 6000 and OPTIMASS 3000.

Inline metering: main flow with OPTIFLUX 6000 (DN 25 / 1"); the flavours are metered in through the side-mounted valves.

Because of the difficult installation conditions in the dispensing system, the measurement systems were delivered as a remote version. The signal converters were installed as 19" rack versions in a separate cabinet. The connection to the control system was realized through a Profibus DP communication.

4. Customer benefits

Two systems of this type were built by the Hansa Industrie Mixer Company and installed and commissioned at Mederer in Fürth. Even though measuring foam with a high air content is not easy, the flowmeters are working to the complete satisfaction of the customer. In spite of the very restricted space available for the installation of 16 measuring devices, the system offers high levels of repeatability and accuracy.

5. Products used

OPTIFLUX 6300 R

- Electromagnetic flowmeter for hygienic applications
- Separate signal converter for installation in a 19" rack
- Nominal width range: DN 2.5...150 / 1/10"...6"
- Vacuum-resistant liner, even with high temperature changes

OPTIMASS 3300 R

- Coriolis mass flowmeter for very small quantities
- Records mass flow volumes of just a few grams per minute
- Secondary pressure containment for high safety



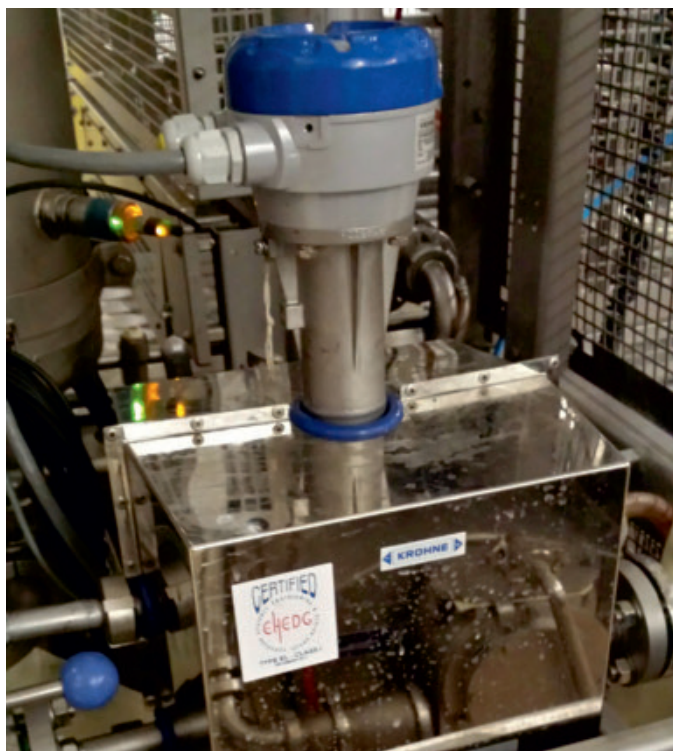
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APPLICATION NOTE Food & Beverage

Dosing liquid chocolate in the production of ice cream

- Filling waffle cones with a chocolate plug
- Coriolis mass flow measurement to control a filling machine
- Incorporation into the control system via a PROFIBUS® DP interface

1. Background

At one of its locations in Germany, a milk processing company also produces milk ice cream. Ice cream in a waffle cone is one of the company's ice cream creations.

2. Measurement requirements

To help the waffle cones maintain their consistency over a long period of time and prevent them from getting soggy, a liquid plug is inserted before filling the cones with ice cream.

Therefore, a filling machine fills each waffle cone with 4...6 gr / 0.13...0.2 US fl.oz. of liquid chocolate.

The amount of chocolate used was not continuously measured in the past. The company had simply started up production and then taken random samples to gradually see when the desired filling level was attained. This resulted in a significant waste of product that could no longer be used due to quality issues.

Medium	Liquid chocolate
Flow rate	100 kg/h / 3.67 lb/min
Density	1.09 kg/m ³ / 0.68 lb/ft ³
Pressure	1 barg / 14.5 psig
Temperature	+33...+37 °C / +91.5...+98.5 °F
Viscosity	130 mPas

For this reason the customer was looking to find a technical solution to better control the filling process. Due to the specifications, a Coriolis mass flowmeter was the instrument of choice for this application. The possibility of entrained gas in the product flow meant that increased requirements were placed on the reliability of the measuring instrument. To enable smooth communication with the existing control unit, the measuring device needed to have a PROFIBUS® DP interface.

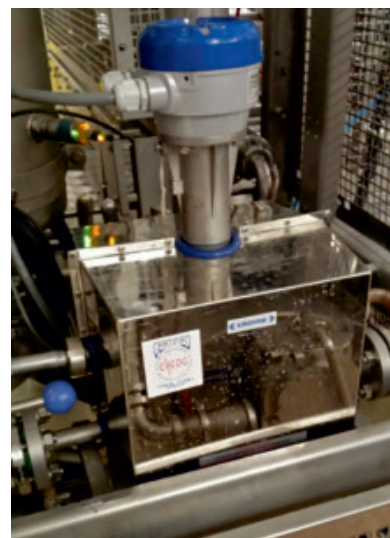


3. KROHNE solution

The ice cream producer decided on the OPTIMASS 6400 F. The Coriolis mass flowmeter was supplied in stainless steel (316 L) with measuring tube size DN 8. It was installed with a hygienic process connection (milk thread as per DIN 11851) in the customer's horizontal dosing line. Because the flow of the chocolate depends on the temperature, the OPTIMASS 6400 was supplied with a heating jacket. This way the medium maintains the desired temperature range (+33...+37 °C / +91.5...+98.5 °F) and cannot solidify.

Unlike other mass flowmeters on the market, the OPTIMASS 6400 maintains operation over a wide range of gas fractions and complex flow conditions. It has been designed for applications with entrained gas thanks to the patented functionality of the "Entrained Gas Management" (EGM™).

The measuring tube for the device is EHEDG-certified and thus guarantees simple cleaning. The OPTIMASS 6400 is connected to the customer's control unit via its PROFIBUS® DP interface.



Dosing liquid chocolate using the OPTIMASS 6400 (with heating jacket)

4. Customer benefits

With the help of the OPTIMASS 6400 the ice cream producer can now automate the dosing process, controlling the amount of chocolate used much more accurately. The result is not only consistently high product quality. Waste is also significantly reduced, allowing the customer to save on both resources and costs on a permanent basis.

The measuring device is very reliable and maintains operation even in the case of entrained gas of up to 100%. This saves the customer expensive process interruptions. The ice cream manufacturer is thus extremely satisfied with the technical advice, the design of the application and the performance of the KROHNE measuring device.

5. Product used

OPTIMASS 6400 F

- Coriolis mass flowmeter for liquids and gases with V-shaped twin measuring tube
- Entrained Gas Management (EGM™): maintains operation with gas entrainment of up to 100%
- Optimised flow divider for minimum pressure loss
- Suitable for hygienic applications (EHEDG, 3A; FDA, EC 1935/2004)
- HART®, FOUNDATION™ fieldbus, PROFIBUS® PA and DP, Modbus etc.



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APPLICATION REPORT Food & Beverage

Dosing of ingredients in chocolate production

- Values measured precisely for consistently high chocolate quality
- Coriolis mass flow measurement for different dosing units
- Straight tube meters for measuring highly viscous media (cocoa mass, lecithin) as well as low viscosity media (cocoa butter, flavourings)



1. Background

Chocolats Halba, a subsidiary of the international retail and wholesale group Coop, is a Swiss manufacturer of premium chocolate specialties. The company annually produces around 17,000 tons of quality chocolate for well-known brands from trade and industry worldwide.

In chocolate production, Chocolats Halba uses only fair-trade cocoa beans. These are refined in the in-house roasting plant and then processed into chocolate at the new production site in Pratteln together with other ingredients.

2. Measurement requirements

During production the cocoa mass obtained from the cocoa beans is mixed with other ingredients such as milk powder, cocoa butter, sugar, lecithin and flavourings to form a creamy mass. Rolling mills then crush the solids in the coarse chocolate mass to a grain size of 0.018 mm. In order to further refine the chocolate and to remove aroma substances from the fat, the now almost finished product is finally "conched" for several hours at temperatures of up to 90°C / 122°F. Only then do the well-known taste nuances unfold. These are essentially determined by the use of the ingredients.

Process parameters:	
Media	Cocoa butter, lecithin, cocoa mass, aroma
Density	900...1200 kg/m ³
Viscosity	100...3000 mPas
Temperature	Up to 50°C / 122°F

In order to ensure the high quality of the chocolate, the chocolate manufacturer must add all liquid ingredients such as cocoa butter, lecithin and flavourings in the correct proportion to the cocoa mass. In particular, cocoa mass and lecithin are sometimes very viscous and are therefore run at higher temperatures. Chocolats Halba was looking for appropriate process instrumentation for high accuracy dosing and mixing of the individual media.



3. KROHNE solution

KROHNE supplied a total of 11 Coriolis mass flowmeters for various dosing tasks:

- 4 OPTIMASS 1400 C with twin straight tube made from stainless steel (size DN25)
- 4 OPTIMASS 7400 C with single straight tube made from stainless steel (size DN25) connected to a heating jacket
- 3 OPTIMASS 7400 C with single straight tube made from titanium (size DN15) connected to a heating jacket

The mass flowmeters in straight tube design are ideally suited for hygienic applications. They are self-draining and cause minimal pressure loss. Due to the low flow velocities of the media to be measured, most measuring instruments are smaller in diameter than the process line.

While the OPTIMASS 1400 C measures non-critical dosing applications with lower viscosity such as cocoa butter, the OPTIMASS 7400 is used for flow measurements of highly viscous media such as cocoa mass due to its single straight tube. In addition, the version with titanium measuring tube offers improved zero point stability in particularly critical dosing applications and thus even higher accuracy (up to a deviation of $\pm 0.05\%$ of measured value).



Picture above and right: OPTIMASS 7400 C with heating jacket; Picture left: OPTIMASS 1400 C

4. Customer benefits

KROHNE's mass flowmeters enable chocolate ingredients to be measured accurately and with long-term stability. This enables the customer to produce the chocolate specialties in consistently high quality according to their recipe. Due to the low pressure loss of the straight tube devices, the flowmeters do not cause an increase in pump capacity, which saves costs. For temperature-critical measuring tasks, the company benefits from the integrated heat tracing of the OPTIMASS 7400, available ex works from KROHNE. This prevents changes in the viscosity of the media and loss of efficiency.

5. Products used

OPTIMASS 1400 C

- Coriolis mass flowmeter with twin straight tube design for universal hygienic applications
- Mass, density and volume flow of gases and liquids; maintains operation even with entrained gas of up to 100%
- Many hygienic connections (DIN, SMS, Clamps etc.)

OPTIMASS 7400 C

- Coriolis mass flowmeter with single straight tube design for advanced food applications with viscous media
- Mass, density and volume flow of gases and liquids; maintains operation even with entrained gas of up to 100%



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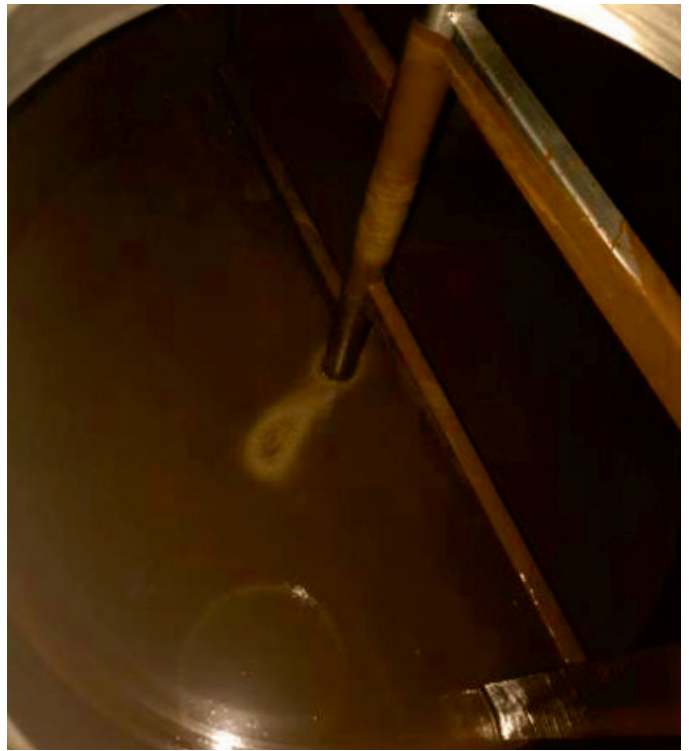
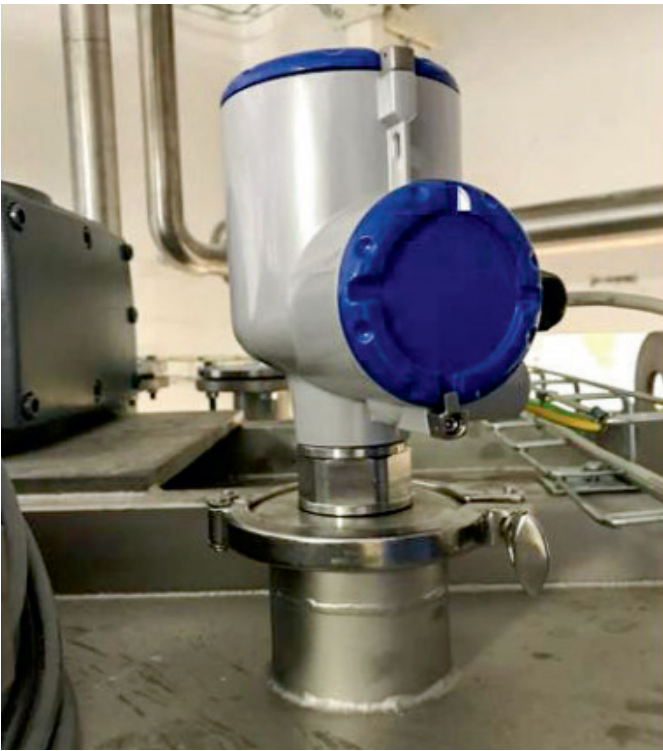
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APPLICATION REPORT Food & Beverage

Level measurement in tanks of liquid chocolate

- Monitoring different kinds of chocolate for a production line
- 80 GHz FMCW radar level measurement in small tanks with agitators
- Automated replenishment of tanks if level falls below a set value

1. Background

Nestlé Česko s.r.o. operates a production site in Olomouc, Czech Republic, and manufactures different kinds of confectionery products.

2. Measurement requirements

The plant operator stores different kinds of liquefied chocolate in storage tanks located outside of the production facility. In order to make them available for production, the different types of chocolate are transported to six smaller tanks inside the plant, where they are temporarily stored and kept at around +45°C / +113°F. These double bottom tanks (1.8 m / 5.9 ft in height) are heated with liquid water. The liquid chocolates are continually stirred by a slowly rotating agitator.

In order to guarantee consistent chocolate supply to the production line, these tanks need continuous level monitoring. In order to automate replenishment of the tanks, the customer decided to equip them with non-contact level transmitters.



Tank with agitator

3. KROHNE solution

KROHNE recommended using the OPTIWAVE 7500 C. Six units of the 80 GHz FMCW radar level transmitter with PEEK Lens antenna were supplied. The 80 GHz technology allows the antenna (DN25) and the process connection to be small. Upon customer request, the radar level devices were provided with G1 thread and subsequently installed via hygienic Tri-Clamp connection manufactured by the food company itself. If it had been required for this application, KROHNE would have been able to deliver radar level devices already equipped with any hygienic connections.



OPTIWAVE 7500 with Tri-Clamp connection

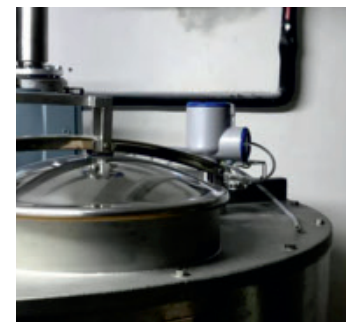
The OPTIWAVE 7500 enables reliable measurement independent of process conditions like temperature, pressure, density or viscosity. It is particularly suitable for liquid applications in small tanks with agitators. Due to its empty spectrum function, false reflections caused by those tank internals are eliminated right away, preventing failed measurements.

The level of each tank is monitored continuously. The readings are transferred to the control room of the plant. Whenever the chocolate level falls below a certain threshold, the tanks are replenished by the storage tanks.

4. Customer benefits

The 80 GHz radar level transmitter helps the customer run an automated process that keeps stock levels constantly replenished. In this way, an uninterrupted supply of chocolate to the production line is ensured. Costly process shut down due to product shortage is prevented. Product output can be maximized according to plan.

The OPTIWAVE 7500 completed the installed base of more than 80 KROHNE level devices already in place at the plant.



OPTIWAVE 7500 mounted on chocolate tanks

5. Product used

OPTIWAVE 7500 C

- Radar (FMCW) level transmitter for liquids in narrow tanks with internal obstructions
- Continuous, non-contact level measurement in small or large tanks with agitators as well as long nozzles
- 80 GHz radar, flush-mounted PEEK Lens antenna
- -50...+150°C / -58...+302°F; -1...40 barg / -14.5...580 psig
- ± 2 mm / 0.08" accuracy



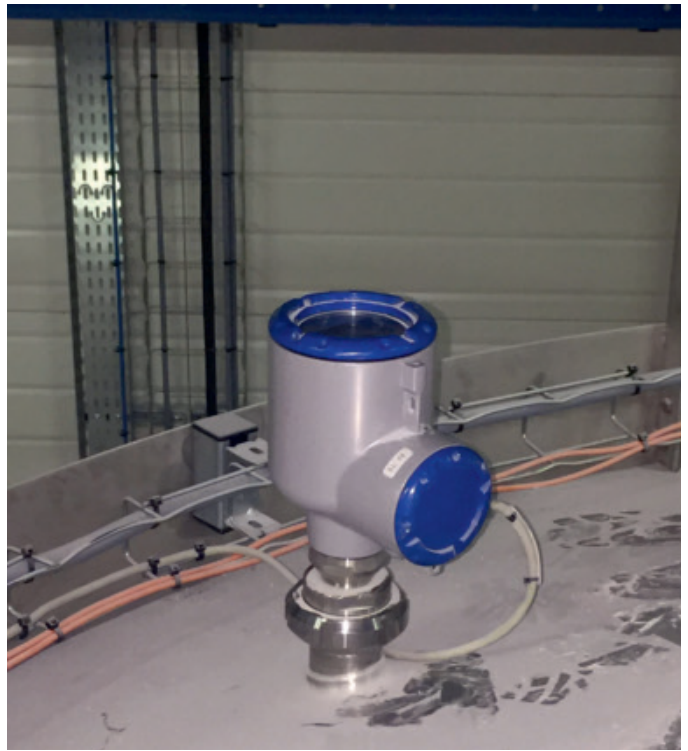
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APPLICATION NOTE Food & Beverage

Level measurement of liquid chocolate in an industrial bakery

- Improved stock management through automated level measurement
- Reliable and accurate readings despite viscous, sticky liquid and moving product surface
- Non-contact hygienic level measurement using 80 GHz radar with non-intrusive PEEK Lens antenna

1. Background

An industrial bakery in France produces chocolate buns using liquid chocolate stored at +45 °C / +113 °F in a tank with conical top and bottom of 4.74 m / 15.55 ft height. Every four hours for ten minutes a rotating scraper removes the chocolate from the tank walls.

2. Measurement requirements

In order to ensure the uninterrupted supply of chocolate for the production of buns, the level of product inside the tank must be continuously monitored. The viscous and sticky liquid tends to build up, especially on intruding measuring probes. Apart from hygienic issues and increased maintenance costs, this can easily lead to inaccurate readings just like the moving product surface resulting from the scraper. In addition, the customer was looking for an automated measuring solution to manage his stock and reduce manual workload. As the tank was new, there had not been any measuring equipment installed so far.

3. KROHNE solution

KROHNE installed the OPTIWAVE 3500 C. This 80 GHz FMCW radar level transmitter is dedicated to liquid applications with hygienic requirements. It has been installed with a DN51 SMS 1145 hygienic connection and a flush-mounted DN25 / 1.5" PEEK Lens antenna. Fitted on top of the tank, the device continuously measures the level of the liquid chocolate and automatically transmits the values to the control room.

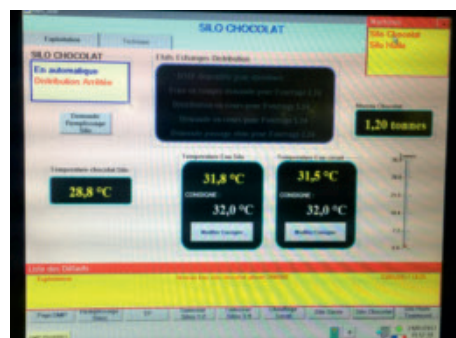


OPTIWAVE 3500 C installed on top of the tank

4. Customer benefits

The customer has optimized the supply inventory and reduced their maintenance and production costs at the same time. The OPTIWAVE 3500 provides continuous and precise readings of the liquid chocolate level right up to the process connection. Its flush-mounted PEEK Lens antenna does not intrude into the tank which avoids deposit and keeps maintenance costs low.

Thanks to its small beam angle, the radar is able to measure agitated product surfaces with an accuracy of ± 2 mm / ± 0.08 ". The measured values are automatically forwarded to the control room. Easy to install, commission and operate, this solution gives a fast return on investment altogether.



Stock management of liquid chocolate

5. Product used

OPTIWAVE 3500 C

- 2-wire 80 GHz non-contact FMCW radar level transmitter for liquids with hygienic requirements
- Flush-mounted PEEK Lens antenna (no tank intrusion)
- Small dead zone and beam angle (8° with DN40 / 1½" Lens)
- Measuring distances up to 50 m / 164 ft
- Suitable for Cleaning-In-Place (CIP) and Sterilization-In-Place (SIP)
- Extensive choice of hygienic process connections: clamps, SMS, DIN 11864-1, VARIVENT® etc.
- ± 2 mm; ± 0.08 " accuracy
- Process conditions up to +150 °C / +302 °F and 25 barg / 362.6 psig
- Quick setup assistant for easy commissioning
- Empty tank spectrum function that eliminates false reflections
- Large backlit LCD display with 4-button keypad and text displayed in 12 languages
- Free PACTware™ DTM with full functionality



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APPLICATION NOTE Food & Beverage

Flow measurement in an oil mill

- Determining the quantity of vegetable oil in production
- Mass flow measurement of a non-conductive liquid
- Control via PROFIBUS® PA interface

1. Background

A food producer in Switzerland operates an oil mill for the manufacture of vegetable oil. The company extracts the oil by pressing the pulp of oil plants (olives, sunflowers, rapeseed). After pressing, the oil is cleaned and refined. The finished end product is then used in the food industry or for the manufacture of biofuel.

2. Measurement requirements

To measure the flow of the vegetable oil, the customer needed a flowmeter that could measure the volume of the non-conductive medium. The pressure loss caused by the measuring device had to be negligible in order to keep pump output low. The devices also had to be maintenance-free, easy to drain and easy to clean. As the PROFIBUS® PA was to take care of the entire process control, the measuring device also had to have an appropriate interface.

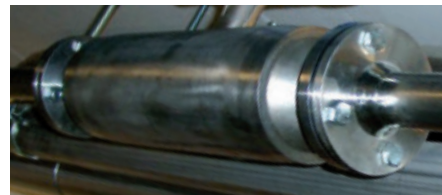
Medium	Vegetable oil
Process temperature	approx. 20 °C (max.: 90 °C) / 68 °F (max. 194 °F)
Pressure	2 bar / 29 psi
Density	0.88...0.93 kg/l / 55...58 lb/ft ³
Viscosity	approx. 160 mPa•s
Measuring range	0...30000 kg/h / 1102.3 lb/min

3. KROHNE solution

KROHNE supplied the OPTIMASS 1300 C. This mass flowmeter is designed to measure the flow of non-conductive, slightly viscous liquids. The OPTIMASS 1300 is self-draining and, thanks to its twin straight measuring tube, causes only very minimal pressure loss. Compared to U-shaped mass flowmeters, the OPTIMASS 1300 features a compact design. The measuring device's PROFIBUS® PA interface transfers the measuring results to a control room.



Flow splitter



Mass flow measurement of vegetable oil

4. Customer benefits

With the help of the OPTIMASS 1300, the oil mill operator can control his production processes. At the same time he benefits from a low-priced mass flow measuring device that features a space-saving design and comparatively high accuracy. There were no additional requirements when it came to installing the straight measuring tube device and no special knowledge was required on the part of the customer.



OPTIMASS 1300 C in a vegetable oil pipeline

5. Product used

OPTIMASS 1300 C

- Coriolis mass flowmeter in twin straight tube design for standard applications in the food and beverage industry
- Optimised flow divider for minimum pressure loss
- Can be used up to 130 °C / 266 °F
- Self-draining and easy to clean
- Options: heating/cooling jackets, purge ports, hygienic connections
- Modular electronics with data redundancy



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APPLICATION NOTE Food & Beverage

Inventory of mustard using non-contact level measurement

- Continuous level monitoring, no risk of overfilling the vessel
- Correct amount of product supplied at the correct time
- Maintenance-free measuring devices

1. Background

Inventory must be checked regularly to ensure that the finished product is continuously supplied to the filling area. The minimum or maximum levels of mustard in the tanks were previously detected using limit switches. Mustard production only started once the minimum limit had been reached which often resulted into shortages.

2. Measurement requirements

A mustard producer in France was looking for a suitable measurement solution for his new warehouse. This included the installation of several non-pressurized buffer tanks that were 4-5 m / 13-16 ft high. The task was to continuously measure the level of different varieties of mustard in these tanks. Continuous measurement would permit the operators to study usage trends and make sure that the finished product is ordered at the appropriate time and supplied in the correct amounts. The customer requested non-contact measurement.

3. KROHNE solution

KROHNE delivered several OPTIWAVE 7300 C FMCW radar level meters with DN 80 / 3" Drop antennas made of plain PP. One device was fitted on each tank roof. This contact-less, 2-wire transmitter continuously measures the level and thereby calculates the product that remains in each tank.

4. Customer benefits

This solution allows measurement of the product level in the tank at any time, enabling the user to optimize supply inventory and reorder batches in a timely manner, without the risk of overfilling the tank. Measurements can also be taken during the filling process. No costly aiming kit is required to install these devices due to their compact design and exceptionally high signal dynamics – an advantage of using FMCW radar technology. Deposits on the antenna are prevented thanks to the ellipsoidal shape, smooth polypropylene surface and completely encapsulated design. This eliminates the need for purging systems or periodic cleaning. The meters come pre-configured; at the time of their commissioning, only a few parameters such as tank height and blocking distance need to be programmed into the transmitter. The OPTIWAVE 7300 gives stable and reliable measurement results while being simple to set up and use.

5. Product used

OPTIWAVE 7300 C radar level meter

- 2-wire FMCW 24...26 GHz radar
- Continuous, non-contact level measurement
- Maintenance-free
- Calibrated at the factory
- Wizard driven setup
- DN 150 / 6" Drop antenna for measuring range up to 80 m / 260 ft



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Source: Process alimentaire

APPLICATION REPORT Food & Beverage

Equipping a mixing facility for edible oil with measurement technology

- More accurate dosing of edible oils
- Traceability of product and energy consumption
- All instrumentation from one provider
- Technical support starting with project planning right through to after-sales care



1. Background

Lesieur is a French food company founded in 1908. It is now a major player in the production and marketing of edible oils and sauces. Lesieur is a subsidiary of Avril, a financial and industrial business in the oil and protein sector, and sells the products under the same brand name. The company has built a new packaging and bottling plant for vegetable oils (rapeseed and sunflower oil) at its Bassens location. This plant, in conjunction with the edible oil refinery of Saipol (another subsidiary of Avril) produces 100 million litres of edible oil per year, in 100 different grades.



Source: Process alimentaire

OPTIMASS 6400 dosing edible oil

2. Measurement requirements

In terms of technology, the goal was to increase the processing capacity of the 100 different types compared to the old facility. Production of the individual mixtures had to take place with maximum accuracy and taking into account the largest possible measuring range. The entire instrumentation had to comply with the standards of the food and beverage industry (EC1935/2004). The customer took on the project management from start to finish but the project planning, procurement and execution was shared by several different locations in France. Consequently, there were different expectations linked to the project.

When it came to technical project planning, the focus was on measuring technology, particularly measuring accuracy. In terms of purchasing, the main focus was on reducing the number of suppliers as well as costs. The production department placed particular importance on service and the user-friendliness of the instrumentation.



3. KROHNE solution

At first competitors bid on this project. KROHNE measurement technology had never been used in the old facility. The customer then learned of the simple and reasonably priced OPTISWITCH 6600 level switch. KROHNE was able to bring its knowledge of instrumentation to the project by providing the appropriate measuring devices for all of the necessary measurements in process and utility applications as well as relevant audits and training sessions.



Source: Process alimentaire

Mass flow measurement with OPTIMASS 1300 minimises product waste

177 measuring devices for pressure, temperature, level and flow were delivered for this facility. One of the project's focal points was the 15 Coriolis mass flowmeters for the three mixing stations into which the raw edible oil from the adjacent production facility was dosed. This allows the customer to provide greater variety of edible oils.

KROHNE was able to set itself apart from the competition when it came to the following points:

- Pre-sales services (design, consultation, project coordination) and customer service (installation verification, commissioning and training)
- As a full-service provider, KROHNE was able to provide all of the instrumentation for pressure, temperature, level and flow
- Good price/performance ratio

4. Customer benefits

According to the technical director at Lesieur, the company assessed suppliers based on the total cost of ownership, taking into account both the operating costs and purchasing costs. The customer was able to reach his objectives in terms of dosing accuracy for the edible oils, accurately tracking consumption in order to minimise waste and monitor process-related energy consumption. In addition, the customer took advantage of service and training sessions that allow him to independently check device performance.

5. Products used

OPTIMASS 6400

- Coriolis mass flowmeter for high accuracy mass flow and concentration measurement in dosing applications



OPTIMASS 1300

- Coriolis mass flowmeter with twin straight tube for universal applications



H250 M40

- Variable area flowmeter for liquids and gases



OPTISWITCH 6600

- Level switch for standard hygienic applications



OPTIBAR P 1010

- Pressure transmitter for simple pressure and level applications



OPTITEMP TRA-S11

- Temperature assembly with replaceable measuring insert



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APPLICATION NOTE Food & Beverage

Flow measurement of tomato paste with entrained gas

- Ensuring consistent product quality in the production of tomato ketchup
- Repeatable and reliable flow measurement of a complex medium with gas fractions
- No more process interruption and production waste

1. Background

A sauce manufacturer operates several production sites in South America. In one of these plants, the company produces high-quality tomato ketchup, which is supplied to retail and wholesale companies as well as other customers in the food industry.

2. Measurement requirements

To help the ketchup maintain its consistency from batch to batch and over a long period of time, a tomato base is finally sieved until a silky consistency is achieved. Passing this paste through the thin filters generates entrained gas naturally, which can be as high as 20% by volume.

As the tomato base is the main raw material of the final product, flow measurement of this fine paste plays a key part in the production process. In order to solve this application, the customer had so far opted for a conventional Coriolis meter from a manufacturer well known in the food and beverage industry. This flowmeter, however, was not up to the challenge of entrained gas present in the fine tomato paste. Whenever entrained gas occurred in the process this Coriolis flowmeter simply stopped measuring, thus affecting the consistency of the sauce recipe which in turn created a lot of waste.

This was highly inconvenient and not at all acceptable for the customer. For this reason, they were searching for an alternative Coriolis mass flowmeter that was able to measure the tomato base product reliably and with excellent repeatability – even in the event of entrained gas.

3. KROHNE solution

KROHNE recommended using the OPTIMASS 6400 C. The Coriolis mass flowmeter prevailed in a test against the previously installed Coriolis meter. The KROHNE flowmeter did extremely well, handling the very complex flow conditions of the silky tomato paste smoothly without interruption.

Featuring Entrained Gas Management (EGM™), this Coriolis mass flowmeter is ideally suited for all sorts of liquids and pastes with gas entrainment. It maintains operation over a wide range of gas volume fractions and complex flow conditions.

The Coriolis mass flowmeter was supplied with tube size DN50 and wetted parts in stainless steel (316L). It was installed with hygienic process connections according to DIN 11851. The twin bent measuring tube of the device is EHEDG certified and thus guarantees simple cleaning. The OPTIMASS 6400 was provided with basic analogue output as per customer request. Digital output options (e.g. PROFINET) could have also been selected by the customer.

4. Customer benefits

With the help of the OPTIMASS 6400 C the main ingredient in the tomato ketchup is continuously measured. This not only helps the customer maintain their consistently high-quality recipes. Product spoilage is also significantly reduced, allowing the customer to save on both resources and costs on a permanent basis.

The salsa manufacturer is extremely satisfied with the technical advice and the performance of the KROHNE mass flowmeter. Unlike other conventional mass flowmeters on the market, the OPTIMASS 6400 C can maintain operation when entrained gas is present in the tomato paste and – what is even more important – provides highly repeatable measurements for consistent food production.



Flow measurement of tomato paste with the OPTIMASS 6400 C

5. Product used

OPTIMASS 6400 C

- Coriolis mass flowmeter with a V-shaped twin bent flow tube for applications with liquids and gases in the food and beverage industry
- Entrained Gas Management EGM™: maintains operation over a wide range of gas fractions and complex flow conditions
- Optimised flow splitter for minimum pressure loss
- FDA, EC 1935/2004 conform; 3A, EHEDG certified
- HART®, FOUNDATION™ fieldbus, Profibus® PA/DP, Modbus, PROFINET, Bluetooth, etc.



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APPLICATION NOTE Food & Beverage

Level measurement of edible oil in a deep fryer

- Monitoring frying oil level in the production of frozen food products
- Continuous, non-contact measurement of a hot and steaming liquid in a very small tank
- Improved frying conditions for an increased product yield

1. Background

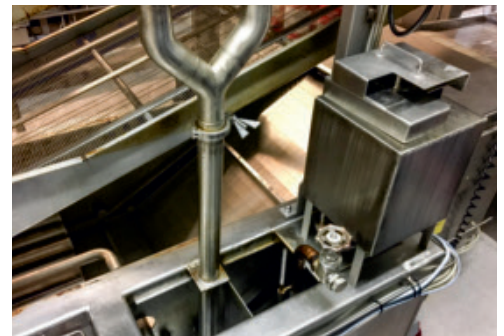
A Norwegian food manufacturer has specialised in frozen food products, ranging from fish and ready meals to vegetables and pastries ending up with frozen fruit dishes. Among others, the frozen food producer supplies retailers, restaurant chains, foodservices as well as other food manufacturers.

2. Measurement requirements

Depending on the final food product, some ingredients are fried in a deep fryer before they are further processed in a tunnel freezer and prepared for delivery. During the deep-frying process, the food is submerged into oil at high heat of +185...190°C / +365...374°F. The fryer tank is just 50 cm / 1.64 ft high.

To optimize the frying process in terms of oil consumption, energy consumption and product yield, the oil level in the fryer needs to be monitored. Previously, the customer did not carry out continuous level measurement in the tank, checking and adapting the oil system manually from time to time.

In order to obtain more stable frying conditions, the operator decided to look out for a non-contact level transmitter. It was not only required that the level instrumentation be suitable for accurate measurement at extremely low measuring distances. The level device also had to be resistant to the hot oil vapour from the fryer.



Deep fryer

3. KROHNE solution

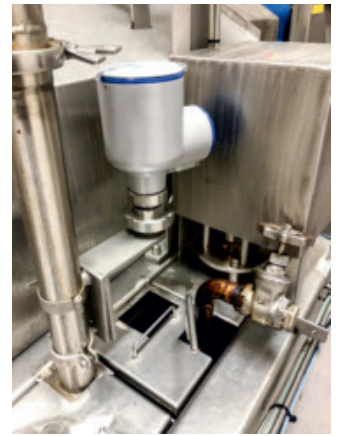
KROHNE recommended the installation of the OPTIWAVE 3500 C radar level transmitter. This 80 GHz FMCW radar is particularly suitable for food applications in small and narrow vessels with very low measuring distances. The level transmitter has been provided with hygienic PEEK Lens antenna (DN25) and was mounted by way of a bracket above the deep fryer.

The very small beam angle of the radar and its high signal focussing allowed the device to be installed far enough above the fryer. In this way, the KROHNE level transmitter is still able to measure through the narrow top hole of the deep fryer right into the medium. Yet, it is still installed far away enough from the hot medium to avoid product-built up and overheating.

The OPTIWAVE 3500 continuously monitors the oil level in the fryer tanks. The measuring values are transmitted via 4...20 mA output to a control room.



Level measurement of hot edible oil



4. Customer benefits

The food producer benefits from improved frying conditions. Due to the stable and reliable level measurement of frying oil in the very narrow and small tank, the customer is now able to only add edible oil quantities that are really required to best meet the production criteria.

The OPTIWAVE 3500 provides extremely stable and reliable measurement values, despite the hot oil vapour. In this way, there is no overflowing of the vessel, or no oil shortage in the fryer either. As a result, the best possible product yield can be obtained by the food company.



OPTIWAVE 3500 mounted above the tank of the deep fryer



Flush-mounted FMCW radar

5. Product used

OPTIWAVE 3500 C

- Radar (FMCW) level transmitter for edible oil and other liquids in the food and beverage industry
- Continuous, non-contact level measurement in high and narrow, small and agitated tanks
- 80 GHz radar, gasket-free Lens antenna
- Measuring range: 0...50 m / 164 ft
- -40...+150°C / +302°F; -1...25 barg / -14.5...362 psig



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APPLICATION REPORT Food & Beverage

Mass flow measurement of pet food flavours and sebum

- Precise dosing of ingredients in the manufacture of different pet foods
- Reliable and repeatable measurement for consistent product quality
- Installation in a vibrating environment



1. Background

Agrofeed, founded in Montevideo, Uruguay, in 1989, is specialised in the production of pet nutrition. The company was the first to apply extrusion technology to pet production, which enabled them to become Uruguay's first manufacturer of different premium foods for cats and dogs. Investment in leading edge technology allows the company to maintain the high quality standards of their products.



Pet food production

2. Measurement requirements

The production process involves two volumetric systems with an intermediary container from where the two main liquid ingredients, i.e. sebum and a mixture of vitamins and minerals, are sprayed over a dry cereal mixture. The process runs 24/7 and requires precise dosing: Adding too little additives and the complete batch has to be rejected, adding too much and the manufacturing cost increases dramatically.

These precious additives had been previously measured volumetrically by way of weigh and fill machines installed on top of a metallic structure, in a vibrating environment. These systems, however, failed frequently and proved to be too unreliable and expensive as they caused a lot of product loss, downtime and maintenance. The customer therefore decided to replace the old systems by flowmeter technology.



Volumetric systems with intermediary container



3. KROHNE solution

Agrofeed decided on 2 OPTIMASS 6400 C Coriolis mass flowmeters for dosing the liquid ingredients into a mixer to combine them with the dry ingredient. The flowmeters were easily configured for the production of the standard as well as premium products and their changing dosing requirements.

The KROHNE devices are able to measure changes in density and temperature so the liquid-based ingredients can be kept in recirculation until uniformly sprayed over the dry cereal mixture.

As for the compact installation of the meters only minimal pipework changes were required. Despite continuous vibration due to pumps and mixing machinery, the OPTIMASS 6400 guarantees a stable and repeatable measurement unaffected by these demanding conditions. Thanks to their crosstalk immunity, the two mass flow meters can operate in close proximity.



Unaffected by vibrating environment: OPTIMASS 6400 C



Dosing of liquid sebum and vitamin mixture

4. Customer benefits

Agrofeed is very pleased with the OPTIMASS 6400 which has solved the problems of production disruption or costly product wastage. There is a continuous monitoring of additives and sebum. Significant measurement errors or even the failure of the measuring system no longer occurs.

5. Product used

OPTIMASS 6400 C

- Twin bent tube Coriolis mass flowmeter for dosing applications in pet food production
- Entrained Gas Management (EGM™): continuous measurement even with gas concentrations from 0...100% and sudden changes in the gas content
- Optimised flow divider for minimum pressure loss
- Suitable for hygienic applications (EHEDG, 3A certified)
- Communication: HART®, FOUNDATION™ fieldbus, PROFIBUS® and Modbus
- Modular electronics concept



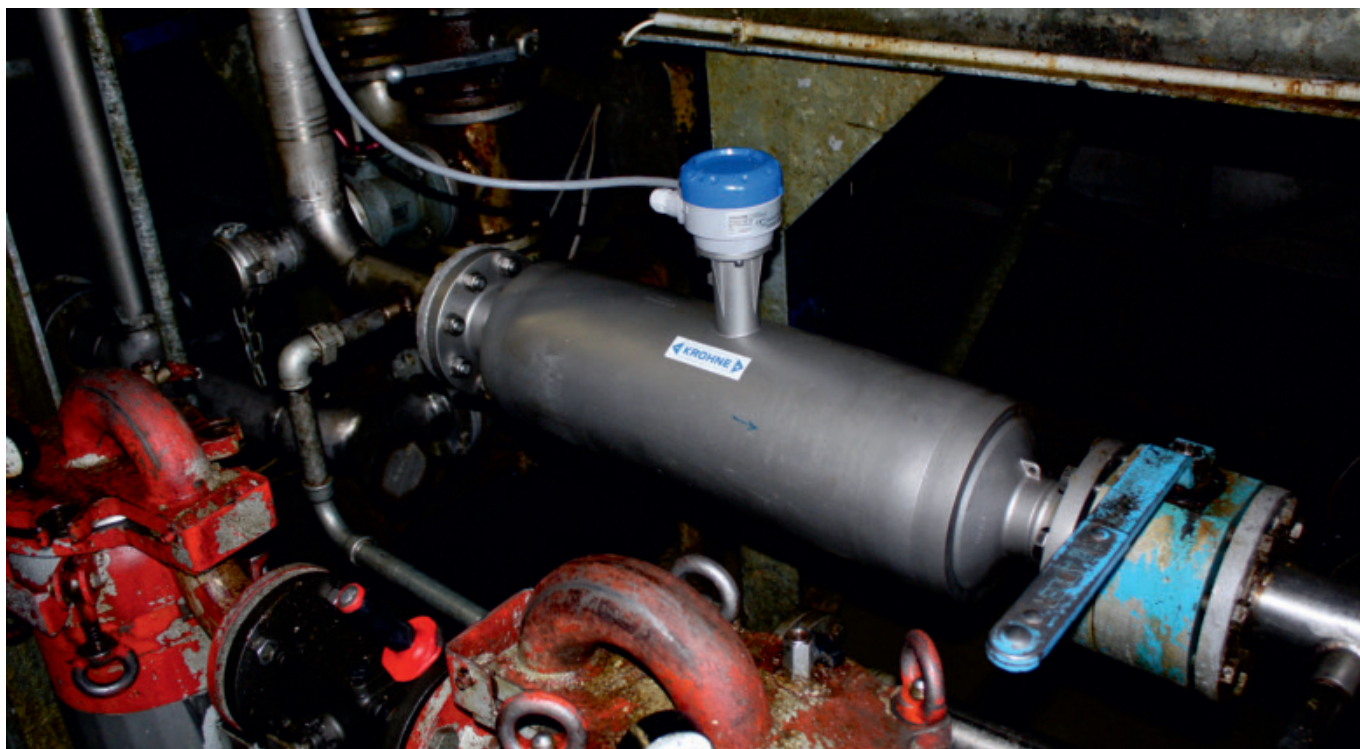
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APPLICATION NOTE Food & Beverage

Measuring the flow of liquid animal fat

- Loading hot liquid fat from animal remains
- Coriolis mass flow measurement of non-conductive medium with highly fluctuating density
- Accurate loading of tanks

1. Background

A waste management company specialises in using animal by-products such as bones, fat and rind. The company operates a treatment facility in which category 3 offal and slaughter by-products are processed into high-quality protein meal and fats used in pet food and agriculture.

2. Measurement requirements

For delivery purposes, the company needs accurate truck loading of its liquid animal fat products. The density of the hot fat can vary considerably during loading depending on the quality and composition of the animal by-products. The customer had previously been using a competitor's electromagnetic flowmeter to determine the load amount. Due to the very low conductivity of the medium, this instrument was, however, unable to guarantee a stable measurement.

Medium:	Liquid fat
Flow rate:	Up to 48 t/h
Density:	approx. 0.8 kg/l / 6.67 lb/gal (US)
Temperature:	+50...+100 °C / +122...+212°F

And as this measuring device primarily determined the load amount as a volume, it did not take into account the varying density of the fat. When converted to mass, this also resulted in measuring inaccuracies with regard to the actual quantity of fat loaded. The customer, therefore, decided to replace the electromagnetic measuring device with an instrument that could determine the mass more accurately and directly.

3. KROHNE solution

The customer opted for the OPTIMASS 1400 F. The Coriolis mass flowmeter was installed directly in the pipe (DN 50) at the loading point. The measuring instrument features a stainless steel twin measuring tube and was supplied with a remote converter for this application. In addition to mass flow, the OPTIMASS 1400 also calculates density and temperature as direct parameters.

KROHNE also provided a preselection counter at the customer's request. This is connected to the OPTIMASS 1400, allowing the exact load amount to be preset. As soon as the relevant amount of fat is reached, the flow is controlled accordingly or stopped via the preselection counter.



Converter (field housing) of OPTIMASS 1400 F above, preselection counter below

4. Customer benefits

Using the OPTIMASS 1400 allows the company to accurately determine the mass of the animal products when loading the trucks. The measuring device operates irrespective of the conductivity of the medium and takes into account the varying density directly. This means no more of the familiar measuring errors during the loading process. With the OPTIMASS 1400, the customer benefits from the most accurate measuring device in its price and performance category.

Thanks to the compact twin tube design of the OPTIMASS 1400, the measuring device was also easy to install without having to make costly changes to the existing infrastructure.

The customer also benefits from the measuring point being fully equipped by KROHNE. Besides the mass flowmeter, KROHNE also supplied a suitable preselection counter for accurate presetting and control of the load amounts.

5. Product used

OPTIMASS 1400 F

- Coriolis mass flowmeter for all standard applications
- With innovative twin measuring tube and an optimised flow divider for minimal pressure loss
- Cost-effective solution for accurate measurement of mass flow, density, volume, temperature, concentration and solid content
- With Entrained Gas Management (EGM™): stability with entrained gas of up to 100 percent
- DN15...100 / ½...4" and 48...170,000 kg/h / 1.76...6,235 lb/min
- Max. -40...+130°C / +266°F
- Best accuracy in its class
- Resistant to installation and process effects
- Easy to drain and easy to clean



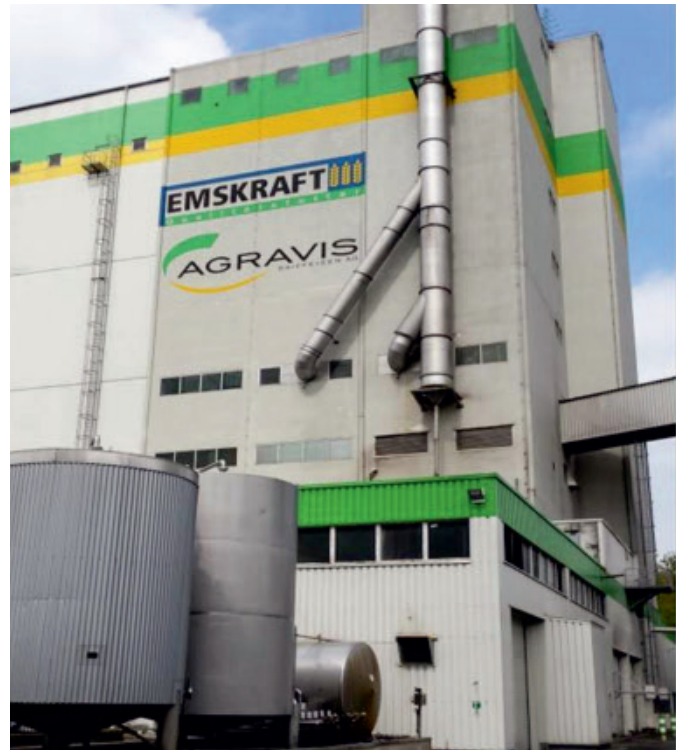
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APPLICATION REPORT Food & Beverage

Level measurement in poultry feed silos



- Quick filling of round silo cells with feed pellets
- Uninterrupted 80 GHz radar level measurement with extremely short response time
- Real-time information for process control in the event of quickly changing levels

1. Background

Raiffeisen Kraftfuttermittelwerk Dörpen GmbH in Germany specialises in the manufacture of high-quality animal feed. Every year the company produces a total of 350,000 tonnes of mixed and special feed, which is then sold mainly to regional agricultural operations. In a separate production building, the concentrated feed factory produces poultry feed among other things.

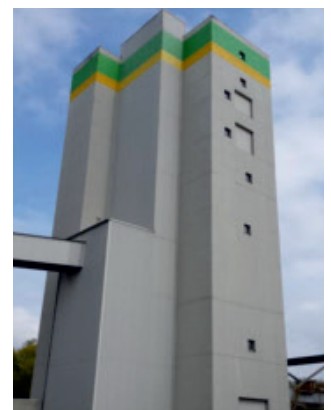


Poultry feed

2. Measurement requirements

The production site stores the prepared poultry feed in a silo block consisting of 21 round silo cells (2 x 2 m / 6.5 x 6.5 ft wide, 9.5 m / 31.2 ft high). The silo cells are loaded in turn by a distributor that fills each silo for a duration of max. two minutes with approx. 1.5 tonnes of feed pellets. After two minutes, the next silo is then loaded. The operator uses level measurement to optimise filling and monitor the inventory of the silo cells.

Previously, the customer had fitted all silo cells with a competitor's 80 GHz radar level transmitter. However, the measuring devices reacted too slowly to changes in level and are generally not suited to the measurement of batch applications with high change speeds. They could only generate the level after the filling process had already been completed. There were no reliable measured values available for the filling itself. The factory operator thus started to look for alternate measurement instrumentation.



Silo block



3. KROHNE solution

The customer decided on a two-week test installation of the OPTIWAVE 6500 C. The 80 GHz FMCW radar level transmitter is designed to quickly fill media with small grain sizes such as feed pellets and can track level changes of up to 60 m/min or 1 m/s (196 ft/min or 3.3. ft/s). Compared to the measuring devices previously used, the KROHNE device boasts a considerably shorter averaging phase. That means that it can generate an extremely stable measured value very promptly. In addition, the OPTIWAVE 6500 enables high signal dynamics, achieving reliable, continuous measurement even with minimal reflection and a bulk cone formation in the silo.

The measuring device was flush-mounted with a PEEK lens antenna (DN70). There is no intrusion into the tank. This way, the level transmitter measures with virtually no dead zone so that the silo can be filled to the roof. It is installed just 20 cm / 7.8 inch from the filler neck used to fill the silo.



OPTIWAVE 6500 C with flush-mounted PEEK antenna



Installation next to filler neck



Measuring points

4. Customer benefits

The OPTIWAVE 6500 tracks changes in level quickly and reliably, even though the measuring point is right next to the filling mechanism. In spite of this potential source of interference and other demanding application conditions (including a low dielectric constant of the medium, agitated product surface and cone formation in the silo), the radar level transmitter met customer expectations immediately. While filling, it provides the feed works operator with the necessary information in real time to optimally control the filling process.

The KROHNE device has proven itself with its quick filling of silo cells, convincing the customer. That is why the animal feed producer decided to equip all 21 measuring points with the OPTIWAVE 6500. There are also plans to use the KROHNE 80 GHz radar at the new plant with 20 other silo cells.

5. Product used

OPTIWAVE 6500 C

- Radar (FMCW) level transmitter for powders and granulates
- Continuous, non-contact level measurement in tall and narrow silos, hoppers or containers up to 100 m / 328 ft
- Extremely high dynamics for accurate measurements of low reflective media in dusty atmospheres
- 80 GHz radar, PEEK lens antenna (DN40, DN 70; 1.5", 2.75")



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APPLICATION REPORT

Food & Beverage

Level measurement of raw feed and grain

- Improved inventory management for intermediate storage and disposition of soybean meal, rapeseed meal and other goods
- Equipping 63 Silos with 80 GHz radar (FMCW) level transmitters
- More efficient logistics processes through enhanced transparency of goods and silo capacities



1. Background

August Eilers GmbH & Co. KG from Bramsche, Germany, specialises in the handling and storage of raw feed and grain for animal feed production. The company operates one of the most efficient transshipment ports for soybean meal, rapeseed meal, wheat bran and grain on a major canal ("Midland Canal") in central Germany.

The products are delivered by the major suppliers by ship from all over the world and temporarily stored on site. Via the port, the family-owned company supplies the mixed feed businesses in North-Western Germany as well as feed wholesalers. The products are loaded onto the customers' trucks via two loading routes. At night customers can load their trucks on their own with a self-service cheque card.



Transshipment port for raw feed and grain

2. Measurement requirements

For interim storage, the company operates numerous silo cells, some of which are very narrow, as well as free-standing round silos up to 20 m / 65.5 ft high. The complex logistics between goods delivery, storage and loading routes require flexibility in planning and thus a high degree of transparency regarding the actual feed stock in the silos.

Until now, the silos have only been equipped with full detectors. In order to enable continuous monitoring of the available goods and silo capacities, the customer planned to equip his systems with new level measuring instruments. Since the silos generate a lot of dust – especially during filling – only measuring instruments that can measure reliably and trouble-free under these conditions were considered. In addition, ATEX approval was mandatory for use in potentially explosive areas with combustible dust.

KROHNE

3. KROHNE solution

After several weeks of testing, the customer decided to use the OPTIWAVE 6500 radar (FMCW) level transmitter. 63 silo cells and round silos were equipped with the KROHNE device. The non-contact level transmitter was installed above the silos with a flush-mounted PEEK (Ø70 mm) lens antenna and low-pressure flange.

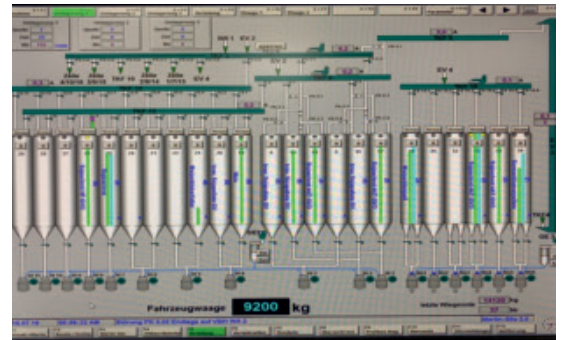
Due to the high signal dynamics of the 80 GHz radar, the OPTIWAVE 6500 is designed for use in difficult level applications with fine-grained, highly dusty bulk materials. Due to the small beam angle of only 4°, the FMCW radar is ideally suited for level measurement in the very narrow feed silos without disturbing reflections from the silo wall affecting the measurement.



Level measurement in raw feed and grain silos

4. Customer benefits

The continuous level measurement enables the customer to store goods accurately and clearly. With a glance into the visualization system, the operator can immediately see which free storage capacities still exist and which feeds are currently available. Accordingly, the filling of the silos and the disposition of the goods can be actively planned. Trucks are loaded on schedule. Since loading can take place both during the day and at night, the on-site workload can also be significantly minimised. The operator benefits from more efficient logistics processes.



Visualisation of silo levels

Compared to four other 80 GHz radars from a competitor installed on site, the OPTIWAVE 6500 has a much better response time during loading and unloading. The KROHNE device reacts faster and measures reliably. The strong signal focussing of the 80 GHz radar offers the decisive advantage here.

Due to the front-flush installation of the radar level transmitters, there is no intrusion of the antenna into the tank. The silos can therefore be filled up to the ceiling almost completely and without dead zones. Storage capacities are optimally utilised.

5. Product used

OPTIWAVE 6500 C

- 80 GHz FMCW radar level transmitter for raw feed, cereals and other applications with extremely dusty bulk solids
- Continuous, non-contact level measurement in high and narrow silos, hoppers or containers up to 100 m / 328 ft
- Extremely high dynamics for clear vision despite dusty atmospheres or low reflective media



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APPLICATION REPORT Food & Beverage

Energy balancing in utility and supply processes at the Krombacher Brewery



- Determining consumption data for internal balancing
- Flow metering hot water, steam and compressed air
- Single-source complete measuring solution

1. Background

Internal energy balancing is an important instrument used by many breweries to determine the leading consumers throughout the entire brewing processes. In the plants, necessary energies such as heating water, steam and air are typically provided without exact knowledge of where and in what quantity they will be required. Virtually every production operation has a compressed air network but only rarely are those networks monitored and adapted to reflect actual consumption rates. Costs can easily be reduced if the compressors used to provide the compressed air can be controlled in keeping with consumption. Even with energy prices under 10 cents per kilowatt hour, it is worth monitoring the compressed air system with measurement equipment as costs created by leaks or untapped output can easily run up into the five figure range over the course of a year. Only when consumption rates have been measured, the processes can be controlled and optimised.

The same is true for steam: along with heating water, steam is one of the most important energy carriers in beer and beverage manufacturing plants. Every major production process, including pasteurisation, brewing, sterilisation, washing and cleaning requires steam or heating water. However, the supply of steam is extremely energy intensive as the boiler is usually fired using liquid fossil fuels or natural gas. Accordingly, it is essential to have accurate measurements of the quantity produced in order to optimise burner control and, ultimately, operate the plant in an efficient and environmentally-friendly way.

With production of around 6.4 million hectolitres in 2008, the Krombacher Brewery Group based in Kreuztal-Krombach is one of the largest private breweries in Germany. In the same year, Krombacher Pils was the best-selling brand of Pils in Germany with sales of around 4.6 million hectolitres. The brewery was looking for a suitable measuring technology solution for its auxiliary and supply processes for energy balancing.

2. Measurement requirements

There were three different measurement requirements to be met:

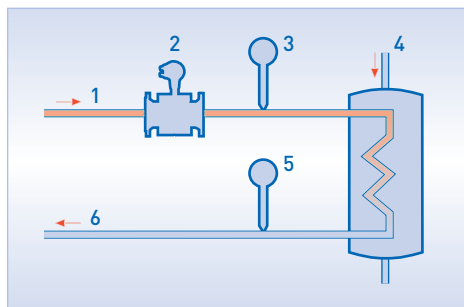
2.1. Measuring the heat flow volume of warm and hot water

The task was to measure the quantity of heat consumed in individual production areas (such as the steam generator, CIP system, heating circuit production or the ventilation system) in two separate heating circuits with the following conditions:

Circuit 1: heating water at 160°C and 14 bar.

Circuit 2: warm water at 90°C and 6 bar.

To determine the quantity of heat used, both the flow rate of the heating water as well as the difference in temperature before and after each consumer must be precisely measured.



Measuring the quantity of heat consumed by a component in a heating circuit

- 1 Feed line
- 2 Ultrasonic flowmeter
- 3 Feed line temperature sensor
- 4 Heat consuming unit
- 5 Return line temperature sensor
- 6 Return line

The objective is to determine both the individual and total demand for heating water, which can then be assigned to individual consumers as costs. No measurements were previously used for heat balancing.

2.2. Measuring the flow rates in the compressed air network

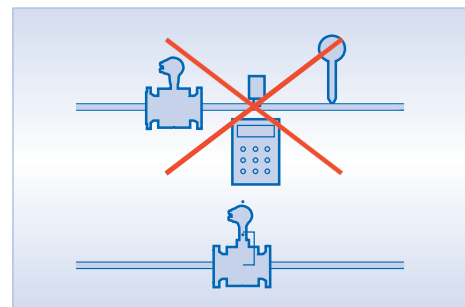
At various points in the compressed air system, the flow rate should be measured in standard cubic metres per hour. The pressure in the system is 7–8 bar at an ambient temperature assumed to be 20 °C ±10 °C.

Here, the objective is to determine consumption profiles and peak consumption to improve compressor monitoring. The measuring devices also detect leaks: if, for example, flow is being measured on a day off, this indicates a leak. The compressed air network is outfitted with measuring devices at various points for this purpose.

2.3. Measuring the flow rate of steam

The quantity of steam produced at each of three steam boilers is to be measured. The medium has a temperature of approx. 175°C at approx. 8 bars of pressure. The demands are as high as those placed on a mass measuring device. The device must be accurate as it is used, among other things, as a reference device for the gas meter of the energy provider. The device must be low maintenance, easy to configure and also feature the option of selecting from various units. The cost of purchase was also a factor when considering whether this type of device would be used.

The objective is to determine both the individual and total demand for steam, which can then be assigned to individual consumers as costs. Measurements have not previously been used for heat balancing.



3. KROHNE solution

Krombacher was looking for a complete supplier, one that could offer a solution for all of these measuring tasks.

3.1. Measuring heat quantity

KROHNE supplied a total of 16 UFM 3030 ultrasonic flowmeters for the heating water measurements. For the temperature measurement, two highly accurate OPTITEMP TRA-S12 temperature sensors are used per installation. They are calibrated and delivered in pairs for minimal deviation. Both temperature signal converters are connected as 2-wire devices directly to the UFM 3030 via the analogue inputs and simultaneously supplied. The converter displays the currently consumed quantity of heat as well as the total consumption in kilojoules or kilocalories per unit of time. A separate temperature controller is not necessary.



Measurement in a building climate control circuit



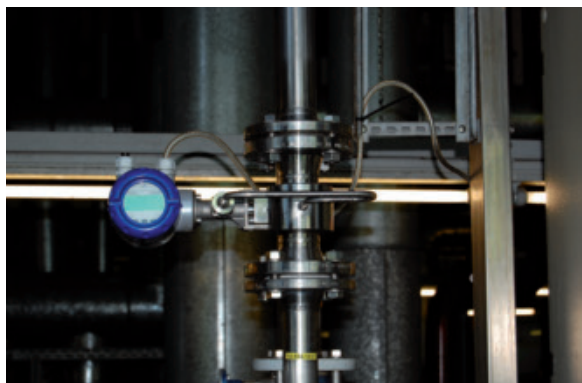
Measurement of the hot water in the brewing house



3.2. Measuring compressed air

Much thought was put into which measuring method would be best suited to the compressed air measurements in terms of the price/performance ratio. As part of the process, internal test measurements were conducted at Krombacher. Thermal mass measuring devices, vortex flowmeters without pressure compensation and the KROHNE OPTISWIRL 4070 C with integrated pressure compensation were tested. The test clearly showed that even the relatively small pressure fluctuations in the compressed air network have serious consequences in terms of accuracy and that pressure compensation is necessary. As the KROHNE device features this function and no additional components such as a pressure transmitter or evaluation unit are needed, the OPTISWIRL 4070 C came out on top with the least deviation compared to the reference device.

A total of 8 OPTISWIRL 4070 C DN 50s were calibrated to standard conditions and used to monitor the compressed air network and the connected consumers. For precise measurements at any time, any changes in pressure or temperature that occur in the network must be accounted for or compensated for during measurement as they can cause such things as the density of the medium to change. That is why the OPTISWIRL 4070 C features integrated pressure and temperature measurement as well as a computer that directly outputs the corrected volume flow.



Flow measurement at the compressor station



3.3. Measuring steam

To measure the amount of steam produced, one OPTISWIRL 4070 C with integrated pressure and temperature measurement was installed per steam boiler (3x DN 200, 1x DN 150). As vortex flowmeters, they primarily measure the volume flow rate and require a specified density in order to display the mass flow of a product. Here, too, the KROHNE device can display the desired parameter directly without the need for an external computing unit.



OPTISWIRL 4070 DN 200 at a measuring point directly behind a steam boiler

4. Customer benefits

With the newly installed measuring equipment, the Krombacher Brewery can optimally monitor and control its auxiliary and supply processes.

The following factors were crucial:

- The complete measuring solution comes from the one source
- By positioning the measuring points, usage and thus costs can be allocated to individual portions or segments
- The measurement data enables the detection of heat and flow rate losses in the circuits
- Consumption profiles can be created for the individual components, enabling the quantity provided to be controlled according to the need
- Hot water energy balancing is possible with just one device, a separate temperature controller is not necessary, thus decreasing installation costs: the temperature sensors are connected directly to the flowmeter via a 2-wire cable
- Reduced installation work and lower measuring inaccuracy even with compressed air and steam measurements thanks to the pressure and temperature compensation integrated into the device
- The KROHNE devices revealed the fewest measuring inaccuracies in the in-house comparison

5. Products used

UFM 3030

- Universal 3-beam in-line ultrasonic flowmeter for liquids
- Independent of conductivity, viscosity, temperature, density and pressure
- No moving or intruding parts, no pressure loss



OPTITEMP TRA-S12 temperature sensor

- High measuring accuracy
- Paired design



OPTISWIRL 4070 C

- 2-wire vortex flowmeter with integrated pressure and temperature compensation
- Suitable for liquids, gases, steam and saturated steam
- Available up to DN 300



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APPLICATION REPORT Food & Beverage

Differential pressure measurement to regulate a vapour compressor

- Heat recovery for the thermal treatment of wort
- Measuring the differential pressure between the vapour chamber and the atmosphere
- Long-term reduction in costs and CO₂ emissions thanks to better automated process steps



1. Background

The König Brewery in Duisburg, Germany, produces the alcohol-free beer König Pilsener Alkoholfrei and the beer-lemonade mix König Pilsener Radler in addition to its namesake, the premium beer König Pilsener. The long-established company stands for both high standards when it comes to product quality as well as the sustainable and cost-saving use of energy sources. To achieve this, the production facilities need to be appropriately designed. The need for heat energy is particularly great when it comes to wort boiling. Generating steam to thermally treat the wort is extremely energy-intensive. In order to sustainably reduce energy costs, the brewery relies on the heat recovery process when boiling wort.

2. Measurement requirements

The vapours generated when boiling wort are collected and compressed. When compressed, the temperature of the vapour increases from 100 °C / 212 °F to about 120 °C / 248 °F, which means that it can then be used again immediately to boil wort.

The König Brewery uses a mechanical vapour compressor to compress the steam. It is only activated when the vapour pressure above the wort reaches a minimum gauge pressure of 25 mbar / 0.36 psi. Until now the company has been using a U-tube manometer to determine the differential pressure. However, as part of the continued modernisation and automation of the plant, this device had to be replaced. A state-of-the-art differential pressure transmitter that could directly transfer its measuring signal to the central control room was required.

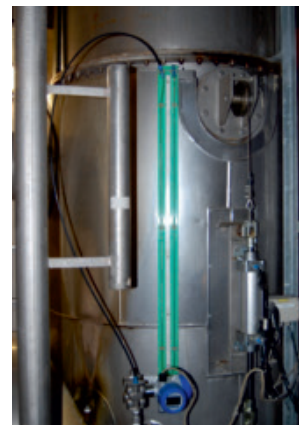


A look at the compressor unit



3. KROHNE solution

The OPTIBAR DP 7060 C differential pressure transmitter was chosen. The KROHNE device measures the vapour pressure above the wort compared to the atmospheric pressure outside of the tank. The extremely compact measuring cell provides the measurements with step response times of just 125 ms to the programmable logic controller (PLC). This guarantees reliable and stable process control. Once the predetermined minimum differential pressure has been reached, the control system activates the vapour compressor.



Differential pressure measurement in the wort kettle

4. Customer benefits

Thanks to the use of the OPTIBAR DP 7060 C, the heat recovery works smoothly via the PLC. The brewery has been able to considerably reduce the energy requirements for this energy intensive process step. Now, considerably less primary energy is required to produce steam for the boiling process. That means that in the long term König reduces both energy costs and CO₂ emissions in beer production. König also benefits from the long service life of the OPTIBAR DP 7060. The sturdy design of the measuring device ensures a reduction in the cost of maintenance and replacement parts.

5. Product used

OPTIBAR DP 7060 C

- Differential pressure transmitter for the measurement of flow, level, differential pressure, density and interface
- Very good repeatability and long-term stability of the measuring signal
- Extremely quick step response times <125 ms
- Measuring ranges up to 30 mbar / 0.44 psi even without electronic spreading
- Turn down up to 100:1, higher on request
- Universal modularity of the entire OPTIBAR process series
- Comprehensive diagnostics and configuration



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APPLICATION REPORT

Food & Beverage

Energy management for a sustainable beer production

- Flow measurement of steam, compressed air, CO₂ and water
- Detecting measurement deviations to avoid losses
- Managing energy to reduce consumption
- A tailored technical proposal



1. Background

Established in France since the 70s, Heineken chose a unique business model as both brewer and distributor.

Heineken has sold 5.7 million hectolitres of beer, including the brands Heineken, Desperados, Pelforth, Affligem and many others such as Fisher and Edelweiss. More than 4000 employees working all over France and the 1.66 billion euros in revenue generated in 2014 illustrate the success of the company's strategic positioning.

To maintain its market position and become the most sustainable brewery in the world, the company invested in the BABW programme (Brewing A Better World) in 2008. The goal is a 40% reduction in CO₂ emissions by 2020.



Vortex flowmeters measuring compressed air

2. Measurement requirements

The group faced the facts and started replacing old equipment such as water heaters and air compressors. In order to move on with the BABW approach and to make further progress, it was necessary to retrofit the process instrumentation used for operating their EMS (Energy Monitoring System). The company focused on 3 priorities: electricity, heating and water. The heating part involved the distribution of compressed air, cold and steam. There were some orifice plates and thermal mass flowmeters installed which, however, dated back to the 1980s and were completely obsolete.

KROHNE

3. KROHNE solution

Measurements are done on utility fluids: steam, compressed air, CO₂ and water. Having taken an inventory of the key points of measurement, specifications were established and sent to different suppliers on the market. After the analysis of the various technical proposals it was the KROHNE solution that was chosen. It came closest to meeting Heineken's needs in terms of standardising measurements so that they can be compared to one another, the dynamics of the broadest measuring ranges and considerable accuracy when detecting anomalies. The customer chose the OPTIFLUX 4300 W electromagnetic flowmeter for water networks, alcoholised water (the alcohol is an antifreeze that retains the food properties) and chilled water. The OPTISWIRL 4070 vortex flowmeter was selected for compressed air and steam and the OPTIMASS 6400 Coriolis mass flowmeter for measuring CO₂. A total of 28 KROHNE sensors were installed. Heineken recognised that KROHNE proposed the best technological solution at the best price.



Electromagnetic flowmeters on water circuits

4. Customer benefits

"Energy is everybody's business" states Heineken's project manager for energy and utilities. Today, these measures help manage investments, e.g. to implement regulations. All employees are to be involved in energy monitoring because it's the best way to reach objectives. When it comes to energy consumption, all relevant information is visualised on a dash board in the control room. The site consists of approximately 250 flowmeters and these new points of measurement generate alerts at the earliest sign of deviation in consumption, enabling immediate intervention to resolve the problem. The French sites have the same equipment and that applies to Eastern Europe as well. Heineken's internal procedure is 90% identical to the ISO 50001 standard and the company has decided to go for this certification.

5. Products used

OPTIFLUX 4300

- Electromagnetic flowmeter for highly accurate bi-directional flow measurement of liquids
- Wide measuring range DN2.5...3000 / 1/10...120"

OPTISWIRL 4070

- Vortex flowmeter for measurement of saturated steam, superheated steam, gases and wet gases with varying process conditions
- Available with integrated pressure/temperature compensation and flow calculation

OPTIMASS 6400

- Coriolis mass flowmeter for liquids and gases with V-shaped twin measuring tube
- Wide measuring range (DN 10...300 / ½...12")



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APPLICATION REPORT Food & Beverage

Multiparameter biogas measurement

- Measurement of methane content, flow, pressure and temperature
- Increased accuracy, maintenance-free installation
- All-in-one measuring device provides full process control



1. Background

Häagen-Dazs is a luxury ice cream produced in France. The North American company General Mills owns the brand and manufactures ice cream and sorbet in Tilloy-lès-Mofflaines in the district of Arras in Northern France. The products contain natural ingredients with no artificial colours or flavours and very little air, providing them with a thick consistency.

2. Measurement requirements

The customer made the decision to invest in a new biogas plant to effectively utilise the production residue treated in its own wastewater treatment plant. This makes it possible to extract methane and use it as a source of energy in cogeneration.

The plant consists of two digestion towers. At the end of the production process, the biogas is treated and water and hydrogen sulphide (H₂S) are removed. The biogas is then used in cogeneration. The biogas powers 3 gas engines. The electricity produced is then sold to EDF. A heat exchanger uses the heat produced by the turbines to heat the fermenters.

Biogas composition	
Methane (CH ₄) content	70% (vol.)
Carbon dioxide (CO ₂) content	26% (vol.)
Oxygen content	4% (vol.)

The biogas must be measured because it is being used to generate heat and power. In order for the process to be as controlled as possible, the flow, pressure and methane content of the medium must be as stable as possible. For this reason, the customer needed to measure the flow of biogas with different gas compositions at the outlet of two digestion towers in two separate pipes. The flowmeters also needed to compensate for changing operating conditions via integrated temperature measurement.



3. KROHNE solution

The methane content in the biogas can be calculated using the sound velocity and temperature. This makes it possible to monitor the performance of the biogas plant. The OPTISONIC 7300 Biogas ultrasonic flowmeter determines the flow of biogas using the differential transit time method. The measuring device also measures the sound velocity at the same time. On this basis and taking into consideration the gas temperature, adiabatic index and the universal gas constant, the flowmeter also calculates the molar mass, which it can then use to determine the methane content with an accuracy of $\pm 1\%$ of the measured value. KROHNE recommended equipping the outlet pipes of both digestion towers with OPTISONIC 7300 Biogas ultrasonic flowmeters. One of the devices was installed in the hazardous area of the plant. This flowmeter features an integrated temperature sensor. It was connected to the OPTIBAR PM 5060 pressure transmitter at the measuring point to calculate the volume flow to standard conditions.



OPTISONIC 7300 Biogas ultrasonic flowmeter and OPTIBAR PM 5060 pressure transmitter installed at the outlet of the digestion tower

4. Customer benefits

The customer has the benefit of an all-in-one device that is capable of taking various measurements (current flow, methane content/ CH_4 , pressure, temperature and total flow). This information enables the company to manage its biogas process accordingly. Based on this multiparameter measurement, Häagen-Dazs decided on KROHNE. The integrated calculation of the methane content in the biogas makes it possible for the operator to accurately determine the energy production of the process. The flowmeter provides measuring results with an accuracy of $\pm 1\%$ of the measured value. The customer benefits from reliable measurements at variable operating pressure, regardless of gas composition. In addition, the device requires no maintenance and features outstanding long-term stability.



Measuring device start-up carried out by a KROHNE service technician

5. Products used

OPTISONIC 7300 Biogas

- Ultrasonic flowmeter for biogas
- Integrated standard volume correction and methane content measurement
- Integrated temperature measurement, integrated pressure sensor optional
- Insensitive to moisture and variable gas composition
- No pressure drop; offers high accuracy and long-term stability
- Also suitable for use in hazardous areas (ATEX Zone 1)



OPTIBAR PM 5060

- Pressure transmitter for pressure and level applications
- Rugged design with metallic diaphragm
- A variety of thread, flange and other connections



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APPLICATION REPORT Food & Beverage

Flow measurement of liquid nitrogen for tunnel freezers

- Consumption measurement for freezing goat cheese
- Use of Coriolis mass flowmeters for continuous flow measurement at -170°C / -274°F
- Cost-effective cryogenic process for the best possible product yield



1. Background

EURIAL is France's second largest dairy cooperative. The group includes 24 dairies and cheese dairies with over 4600 employees. The milk processor specialises in the three business areas "conventional cow's milk", "organic cow's milk" and "goat's milk". The EURIAL Group sells its milk products to all major food retailers, wholesalers, restaurant chains and food manufacturers.

2. Measurement requirements

Before it is supplied to restaurants and food producers, goat cheese is fed into tunnel freezers after production. This cryogenic freezing allows the cheese to be preserved for a long time.

For cryogenic processing the company uses liquid nitrogen with a temperature of around -170°C / -274°F that is driven into a cooling system at a pressure of 1.4...2 bar / 20.3...29 psi. As the medium is cost-intensive the cryogenic process must be operated as efficiently as possible. It is therefore important for the customer to continuously determine the liquid nitrogen consumption in his two tunnel freezers.



Tunnel freezer for cryogenic freezing of goat cheese

In the past, the customer had the liquid nitrogen consumption checked only every two years by a service company. However, this sporadic bypass measurement was too inaccurate to identify efficiency loss. In order to permanently optimise the cryogenic process and save costs, the company decided to continuously determine the current and total nitrogen flow.



3. KROHNE solution

KROHNE recommended the OPTIMASS 6400 F for this cryogenic application. Due to its high-end options, the Coriolis mass flowmeter with twin bent tube is ideally designed for the flow measurement of cryogenic media such as liquid nitrogen.

The customer uses the OPTIMASS 6400 in the supply lines to both tunnel freezers. The flowmeters were supplied in size DN25 with measuring tubes made of stainless steel (1.4404 / 316L). In addition, both instruments were completely equipped with insulating housings ex works. In order to be able to carry out a zero point calibration of the measuring instruments on site, a valve was mounted behind each Coriolis meter.



Mass flow measurement of liquid nitrogen for tunnel freezers with the OPTIMASS 6400 F



4. Customer benefits

By continuously and accurately determining the current and total mass flow, the customer benefits from precise monitoring of liquid nitrogen consumption.

Using the OPTIMASS 6400 helps the dairy cooperative constantly optimise the cryogenic process to always supply both tunnel freezers with the same amount of nitrogen. This ensures cost-efficient freezing of goat cheese with the best possible product yield in mind.



Shock-frozen goat cheese leaving a tunnel freezer; above: OPTIMASS 6400 F

5. Product used

OPTIMASS 6400 F

- Coriolis mass flowmeter for cryogenic applications (down to -200°C / -328°F) in food and other industries
- Highly accurate measurement of mass flow, density and volume flow
- Flange: DN10...300 / 1/2...12", max. PN 160 / ASME Cl 1500
- Also available as hygienic version



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APPLICATION REPORT Food & Beverage

Equipping a cleaning in place (CIP) system with flowmeters

- Control of disinfection processes in food production
- Electromagnetic flow measurement of water, acid and brine
- Cost-effective and reliable instrumentation for dosing of CIP agents



1. Background

The Turkish company Ünsa Makina engineers and builds turnkey equipment for food producing companies. Among other things, the company specialises in the design and manufacture of CIP (Cleaning in Place) units. The CIP plants are completely equipped ex works with instrumentation in accordance with customer specifications.



Ünsa Makina manufacturing plant

2. Measurement requirements

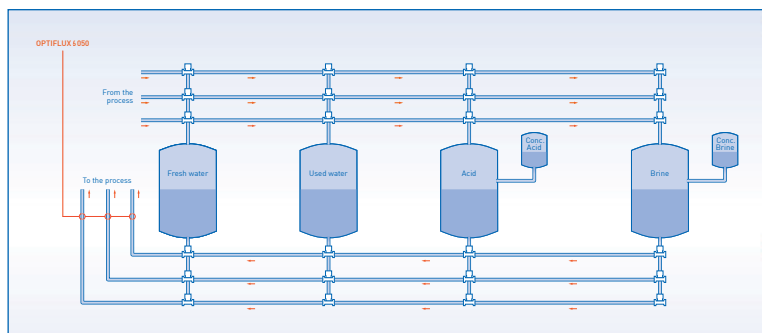
For the new CIP plant of a customer, Ünsa Makina was searching for tried and tested flowmeters to enable flow control of the various CIP agents. The CIP system in this project comprised four different lines that can be operated simultaneously to run different cleaning procedures at the same time. The CIP agents to be measured are fresh water, used water, acid and brine.

Application Parameters	
CIP agents	Fresh water, used water, acid, brine
Flow rate (max.)	20,000 l/h
Temperature	+65...80°C / +149...176°F
Pressure	6...7 bar / 87...101.5 psi



3. KROHNE solution

The equipment manufacturer decided in favour of the OPTIFLUX 6050 C electromagnetic flowmeter (EMF). This mag meter is a cost-effective yet highly reliable instrument for measuring the various conductive cleaning agents. Due to its standard PFA liner, the flowmeter can also handle more corrosive agents like acid, brine and caustic solutions.



General process scheme of a CIP system with the OPTIFLUX 6050

The KROHNE device has also no crevices, gaps or blind spots and is specifically designed to stay free of contamination. This way, it complies with the most stringent hygienic demands in the food and beverage industry. To meet the customer's requirements in terms of process connection, all flowmeters were equipped with DIN 11851 hygienic connection.



OPTIFLUX 6050 C on CIP skid unit



ÜNSA Makina CIP system

4. Customer benefits

The OPTIFLUX 6050 provides the customer with reliable flow measurement to run a state-of-the-art CIP system. The flowmeter monitors the current volume flow rate and the total consumption of the various CIP lines, allowing the operator to control the CIP dosing accordingly. In this way, the right amount of CIP agents can always be calculated and added for safe disinfection. An accidental but costly overdose is prevented in the same way as an undersupply of the CIP lines.

The very cost-effective flowmeter is sufficiently accurate for this basic application, yet long-term stable with a proven track record for measuring CIP agents. Extensive digital communication options were not required. Process control of the CIP process is done using the simple analogue and pulse outputs of the EMF. KROHNE service specialists commissioned the flowmeters prior to delivery of the CIP system.

5. Product used

OPTIFLUX 6050 C

- Cost-effective flow measurement in the food sector
- Meter size: DN2.5...150 / 1/10...6" (3A, EHEDG, etc.)
- Many hygienic fittings
- PFA liner reinforced with embedded stainless steel grid for vacuum resistance
- Maintenance free
- 4...20 mA, pulse, frequency, status, HART®, Modbus



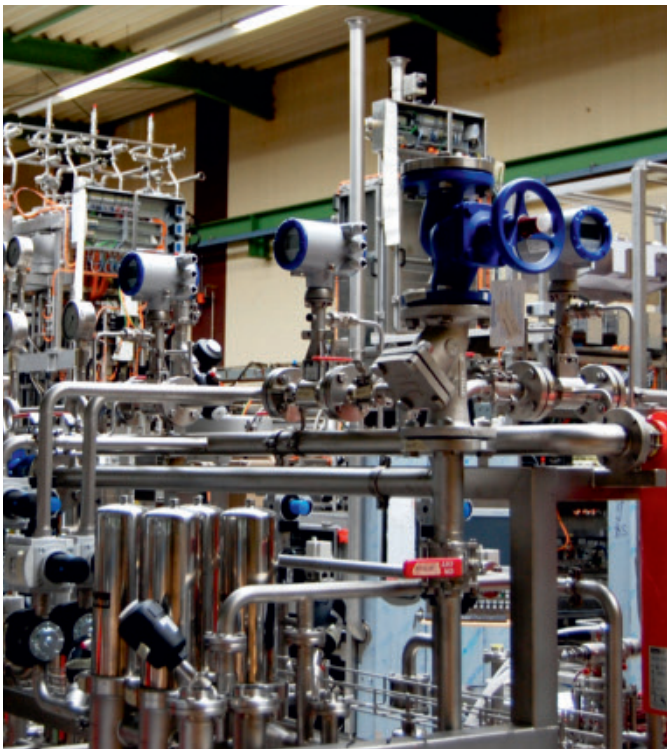
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APPLICATION REPORT Food & Beverage

Vortex flow measurement of carrier air in a sterilisation facility

- Flow control in a packaging machine for the sterile closure of yogurt pots
- Determination of the standard volume flow to maintain operational tolerances
- Optional media balancing to flexibly adjust to future changes in packaging material



1. Background

NSM Packtec GmbH, based in Ahaus, Germany, designs, manufactures and installs high-performance packaging machinery for international companies in the dairy and beverage industry according to customer specifications. NSM's portfolio includes pot molding, filling and closing machines (FFV). These facilities are designed according to an integrated aseptic concept and use hydrogen peroxide (H_2O_2) for the inline sterilisation of all of the packaging materials.



Sterilisation system

2. Measurement requirements

NSM manufactured a packaging machine with just such a sterilisation system using the H_2O_2 spray method for a milk processing operation in the USA. In this procedure, the materials to be sterilised are sprayed with a heated H_2O_2 aerosol that is versatile and non-destructive. Heated, sterile carrier air is fed to an aerosol lantern in order to convey the H_2O_2 aerosol generated there to a spray chamber. It is then sprayed on to a heat sealing film for sterilisation. The heat sealing film is then applied as a seal for the yogurt pots in the packaging machine. The carrier air must be supplied in a defined quantity to guarantee a consistent, even coating. The plant manufacturer was looking for a suitable flowmeter to accurately monitor the flow of the carrier air even at fluctuating pressures (6...8 bar / 87...116 psi) and temperature conditions (approx. 40 °C / 104 °F).



3. KROHNE solution

NSM decided on the OPTISWIRL 4200 C. The DN 25 vortex flowmeter was installed in the non-sterile area of the sterilisation facility. The device measures the standard volume flow of the carrier air for the aerosol lantern. The air is reduced or regulated to the plant operating pressure, cleaned using sterile filters, heated up and conveyed to the aerosol lantern.

Due to fluctuating process conditions, KROHNE recommended using the device with integrated pressure and temperature compensation. This puts the OPTISWIRL 4200 in a position to take into account fluctuating process conditions when calculating the standard volume while guaranteeing correspondingly high accuracy.



OPTISWIRL 4200 C for the measurement of carrier air

4. Customer benefits

The OPTISWIRL 4200 C guarantees continuous sterilisation of the heat sealing film used to seal the yogurt pots. As the vortex flowmeter measures pressure and temperature in addition to volume flow, there are no additional installation costs for separate pressure or temperature sensors. In addition, familiar measuring errors are eliminated as the OPTISWIRL 4200 measures all parameters at one single position.

Along with increased accuracy and process reliability, the end customer in the dairy industry also benefits from the possibility of quantity balancing for the measuring device. This makes it possible to flexibly adapt sterilisation and sealing in the face of changing requirements. This way, for example, the sealing of the yogurt pots can be adjusted according to changing film materials and dimensions.

5. Product used

OPTISWIRL 4200 C

- Vortex flowmeter for conductive and non-conductive liquids, gases and steam
- Integrated pressure and temperature compensation for auxiliary and supply circuits with changing process conditions
- Advanced technology for signal filtering
- Measuring range: DN15...300 / 1/2...12"
- Also available with integrated nominal diameter reduction
- Developed according to IEC 61508, Edition 2, for SIL2
- ATEX, IECEx, QPS, NEPSI etc.
- HART®, FOUNDATION™ fieldbus and PROFIBUS® PA



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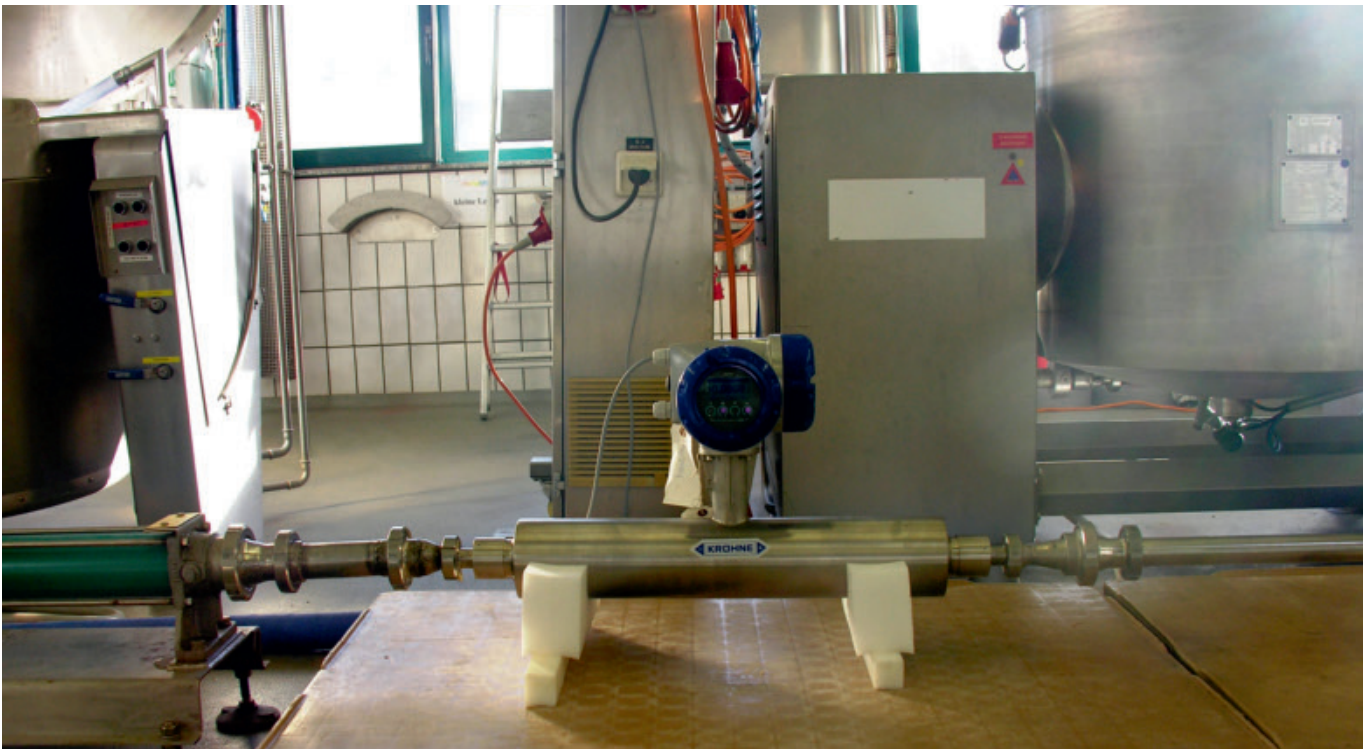
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APPLICATION REPORT Food & Beverage

Mass flow measurement of spinach sauce



- Highly precise dosing of a seasoned sauce mixture to produce creamed spinach
- Measuring a viscous product with entrained gas and fluctuating density
- Consistent product quality and low production costs made possible by use of a mass flowmeter with a straight measuring tube

1. Background

Iglo GmbH is Germany's and Europe's leading brand of frozen food, specialising in fish, vegetables and poultry. The company is known for its sustainable production methods and use of local produce. In its factory in Reken, Germany, Iglo produces frozen food using vegetables and herbs harvested by farmers in the direct vicinity of the facility. The most well-known product produced here is the spinach with the "blub". For this creamed spinach, the freshly harvested spinach is blanched, chopped and seasoned with a herb sauce mixture. Once the spinach is ready to serve it is frozen.

2. Measurement requirements

Adding the seasoned sauce mixture requires a high degree of accuracy and stability to keep a consistent ratio of sauce to chopped spinach. Many quality factors (including flavour, consistency and look) as well as production costs depend on this.

The spinach sauce is a challenging product which, as expected, is difficult to measure accurately. It is a non-Newtonian, non-conductive, viscous liquid with a viscosity of >10,000 mPas and sporadically occurring entrained gas. The customer had already been using mass flowmeters from different market competitors to measure the mass flow of the sauce even when the density fluctuated. Iglo's goal is to lower application-linked measurement errors in practice to well below $\pm 2\%$.

3. KROHNE solution

Iglo made the decision to test another Coriolis mass flowmeter, the OPTIMASS 7400 C. The high-performance device boasts a single straight tube design and EGM™ (Entrained Gas Management) functionality and is designed for demanding applications where gas bubbles may be an issue.

The test setup consisted of:

- 1 OPTIMASS 7400 with Titanium (DN 25) measuring tube,
- 1 test plate,
- 1 four-stage mono pump,
- 1 pressure-sustaining valve and
- 1 calibrated scale with a resolution of 100 gr (ca. 3.4 US fl.oz.).



Test installation with the OPTIMASS 7400 C

Once heated, the sauce was first pumped in a circuit to obtain a good mix and even consistency. Due to the low flow, KROHNE then calibrated the zero point of the OPTIMASS 7400 C in three test runs. This optimised efficiency so that the measuring device achieved an error of measurement of just $\pm 0.6\%$ under operating conditions.

4. Customer benefits

The OPTIMASS 7400 C makes it possible to dose the spinach sauce much more accurately. Measuring accuracy is significantly higher, ensuring more constant product quality and lower production costs. In addition, pump output can be permanently reduced as there is much less pressure loss with the OPTIMASS 7400 C's large single straight tube. This further reduces costs. Compared to the measuring devices previously used, the KROHNE device featuring the EGM™ function enables better signal processing and guarantees considerably higher measurement stability in the case of entrained gas in the product.

Iglo was won over by the improvements and savings made possible. When it comes to the upcoming system expansion, the company is relying on the OPTIMASS 7400 C. The KROHNE mass flowmeter is designed both for sauce measurement and the subsequent measurement of the spinach/sauce mixture.

5. Product used

OPTIMASS 7400 C

- Coriolis mass flowmeter with straight measuring tube
- For challenging applications with liquids and gases
- Measurement of mass, density, volume and concentration
- Entrained Gas Management (EGM™): Continuous measurement even at gas concentrations from 0...100% and sudden changes in gas content
- DN 10...100 / 1/2...4", all hygienic standard connections available
- EHEDG, 3A; FDA, EC 1935/2004
- On-site testing of converter electronics and sensor with OPTICHECK
- HART® 7, FOUNDATION™ fieldbus, PROFIBUS® PA and DP, Modbus



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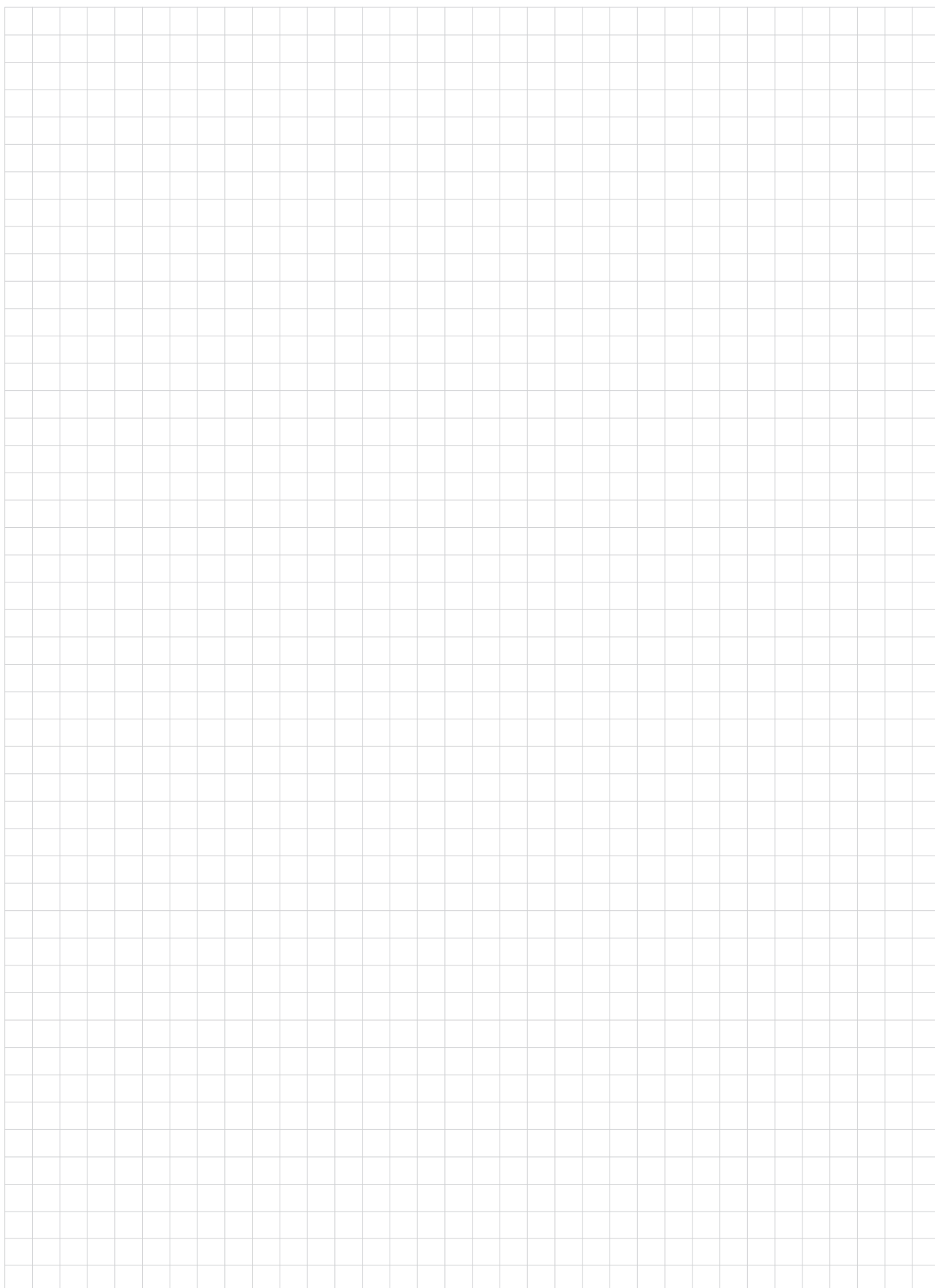
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