



APPLICATION REPORT

Food & Beverage

Flow control in the production of fermented alcohol vinegar



- Precise dosing of vinegar to denature bioethanol for the manufacture of spirit vinegar
- Custody transfer measuring system for vinegar in accordance with MID MI-005
- Increased speed and accuracy of denaturation process thanks to Coriolis mass flowmeters

1. Background

Burg Group is a leading European manufacturer of fermented alcohol vinegar, commonly known as “spirit vinegar”. This natural form of acetic acid is produced from renewable resources such as sugar beet and sugar cane. The company specialises in the production of food-grade vinegar and is also at the forefront of sustainable manufacturing of biodegradable household cleaners and algae removers. Burg Group operates five different production sites across Europe, including one located in Bzenec, Czech Republic.

2. Measurement requirements

To produce spirit vinegar, the plant uses denatured ethanol as the starting material. Denaturation is carried out on-site by mixing bioethanol with defined quantities of natural vinegar, which renders the alcohol undrinkable through esterification. The denatured product is then mixed with nutrients, acetic acid bacteria and oxygen in a tank to start acetous fermentation, converting the bioethanol into fermented alcohol vinegar. The resulting spirit vinegar is subsequently diluted with water to achieve the desired concentration for the final product, typically between 4% and 20%.

Parameters of spirit vinegar line	
Measured medium	Fermented alcohol vinegar
Mass flow rate	approx. 6000 kg/h / $\approx 13,228$ lb/h
Density	$1028 \text{ kg/m}^3 / \approx 64.2 \text{ lb/ft}^3$
Pressure	6 barg / 87 barg
Temperature	$+40^\circ\text{C} / +104^\circ\text{F}$

The denaturation process is subject to customs supervision. Previously, the company mixed bioethanol and vinegar in a tank, a procedure that took five to six hours and required customs officers to be present throughout. Over time, this proved to be inefficient and costly. As a result, the plant operator decided to implement an inline mixing process to accelerate production. This approach required accurate inline flow measurement of both alcohol and vinegar. To comply with customs regulations, it was essential to monitor and record the amount of vinegar added to the alcohol, and to do so in accordance with the Measuring Instruments Directive (MID) MI-005 for liquids other than water.

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3. KROHNE solution

Thanks to its long-standing experience in planning and engineering custody transfer systems, KROHNE was entrusted with setting up the new inline blending process. The solution of choice was a control loop comprising an OPTIMASS 1400 Coriolis mass flowmeter for ethanol, and an MID MI-005-compliant measuring system featuring the OPTIMASS 6400 Coriolis mass flowmeter. Alcohol and vinegar are now fed to a static mixer, which ensures inline denaturation of ethanol.

Flow measurement of the fermented alcohol vinegar added to the alcohol stream is done by the OPTIMASS 6400 Coriolis meter. The bent-tube flowmeter is among the most accurate on the market and has a proven track record in custody transfer applications. It was supplied with a stainless steel measuring tube in size S25. To maintain the vinegar at the required temperature, both the vinegar line and the Coriolis meter were insulated. The vinegar flow rate is regulated by a control valve to achieve the desired alcohol-to-vinegar ratio.

The ethanol flow rate is monitored using the OPTIMASS 1400 Coriolis meter. The device is used for alcohol dosing but is not subject to customs regulations in this application. The twin-straight meter was supplied in stainless steel, size 50 (S50). To prevent dry running of the pumps in the vinegar and alcohol lines, KROHNE also supplied OPTISWITCH 5100 vibration switches along with a suitable channel controller to power and process the measuring signals of the switches. ATEX certification was mandatory for all instruments due to the risk of explosive atmospheres.



Ethanol denaturation station



MI-005 measuring system for vinegar with OPTIMASS 6400



Flow measurement of bioethanol with the OPTIMASS 1400



OPTISWITCH 5100 for dry-run prevention of pumps

4. Customer benefits

The measuring system has a significant impact on the speed of the denaturation process. It greatly streamlined operations and eliminated the need for customs personnel to be present during mixing. The customer was very satisfied with KROHNE's approach, which contributed to reducing time, manual effort and operational costs. While previously only two trucks could be unloaded at best, the handling of three trucks is feasible today.

All components, from engineering to instrumentation, were provided from a single source, ensuring seamless integration and support. For the installation of the complete measuring system, the setup was tested and conformity-assessed in accordance with the Measuring Instruments Directive 2014/32/EU under Module B + F. The Module F conformity assessment along with the final metrological inspection, was carried out by a notified body at the customer's site. All after-sales services, including legally required system verification, are also handled by KROHNE, ensuring continued compliance and operational reliability.

5. Products used

OPTIMASS 6400

- Coriolis mass flowmeter for custody transfer applications

OPTIMASS 1400

- Coriolis mass flowmeter for universal applications and process control

OPTISWITCH 5100

- Vibration level switch for process applications



Contact

Would you like further information about these or other applications?
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