



APPLICATION NOTE

Chemical

Flow measurement of aldehyde reaction products with entrained air

- Mass flow measurement to ensure a minimum flow
- Constantly high measurement quality despite variable gas content in liquid medium
- Integration in control system as safety-critical application

1. Background

A chemical company in the wider Rhine-Main region, Germany, operates a production plant for aldehyde reaction products. These are used as intermediate products in the pharmaceuticals industry and agriculture as well as curing agents in the manufacture of epoxy resins.

2. Measurement requirements

There is PCT safety equipment in place for the production process to ensure the safety of the plant and to minimise the risk to human health and the environment. The design is such that the safety function is controlled using a continuous mass flow measurement by two measuring devices operating in series. The measurement deviation of the two devices is monitored as part of the safety concept. The liquids are transported at +70 °C / +158 °F and at a density of approx. 1 kg/l or 0.036 lb/in³. Due to the chemical properties of the media and the nature of the process, there is recurrent gas entrainment.

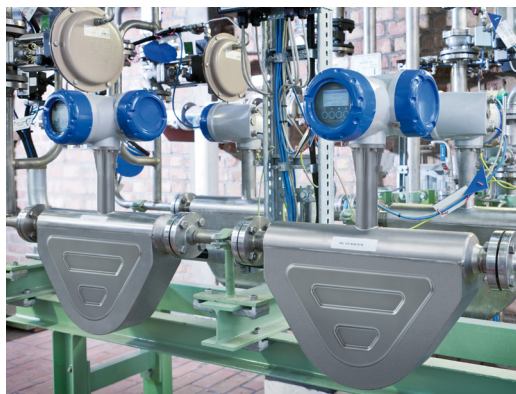
The customer has used mass flowmeters by a competitor in the past. However, the gas contained in the medium significantly compromised the measuring performance of these devices. For example, when gas bubbles occurred, the measuring devices automatically switched to error mode. There were also major deviations in the readings. It was, therefore, impossible to obtain continuous, reliable measured values.

The operator set about looking for a new technical solution to maintain the PCT safety function, which would be able to measure continuously and reliably in spite of the occasionally very high gas content.

3. KROHNE solution

The customer opted for the OPTIMASS 6400 C. This Coriolis mass flowmeter with twin bent tube design was supplied in a stainless steel version (1.4404 / 316L). It was connected by flange. Due to spatial conditions, the device was installed at the highest point of the plant section, upstream of a descending pipe and on the suction side of a pump.

Unlike other widely available mass flowmeters, the OPTIMASS 6400 is immune to the negative effects of entrained air. Thanks to the patented functionality of "Entrained Gas Management" (EGM™), the measuring device can continuously measure the mass flow, even if entrained gas occurs. Instead of switching to error mode or freezing at the last stable measured value to circumvent the loss of measuring signal, the OPTIMASS 6400 can track the actual frequency of the measuring tube and reliably calculate the flow.



PCT safety equipment with OPTIMASS 6400 fitted in series

4. Customer benefits

With the OPTIMASS 6400 C the operator can reliably and continuously keep track of the flow and ensure that it does not drop below the minimum. Thanks to their EGM functionality, the two mass flowmeters continue to measure, even when there is a high gas content in the medium. The chemical company no longer has to shut down its plant for safety reasons because of deviations between the two measured values.

Unlike the mass flowmeters previously used, KROHNE's devices work continuously. For the customer, this means more than just safe operation of the plant. The company also avoids unnecessary downtime and makes considerable cost savings as the PCT safety equipment can be operated without interruption. This means a permanent increase in the quality and volume of the product.

5. Product used

OPTIMASS 6400 C

- Standard measuring device for SIL and process applications in the chemical industry
- Suitable for applications with gases and liquids
- With Entrained Gas Management (EGM™): Stability with entrained gas (gas concentrations 0...100%)
- For cryogenic (-200 °C / -328 °F), high temperature (+400 °C / +752 °F) and high pressure applications (200 barg / 2900 psig)
- Measuring tube made of stainless steel, Hastelloy or Duplex
- Advanced diagnostic functions and status displays in accordance with NAMUR NE 107
- High accuracy for custody transfer (approved to OIML R117, R137, MI-005, MI-002)
- HART®, FF, PA, DP, Modbus



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