

Application note: Chemical **KROHNE**

▶ measure the facts

# ▶ Measuring viscous liquids with entrained gas bubbles

- Mixing of polyol and isocyanate for the production of polyurethane foams
- Coriolis mass flow measurement of liquids with entrained air
- Enabling a continuous measuring operation for coordinated dosing procedures

## Background

A chemical company producing polyurethane foams which are supplied to various industries as insulation and filling materials needed a solution for coordinated dosing of chemicals.

Chemical precursors for the forming of the polyurethane products are polyol and isocyanate. Both chemicals are brought to spontaneous reaction in a process called polymerisation. In order to form the desired cross-linked polymer end products, the polyol and isocyanate have to be mixed at the required ratio.

Medium	Polyol
Density	1.2 kg/L / 75 lb/ft <sup>3</sup>
Viscosity	9000 cP
Temp.	25 °C / 77 °F
Pressure	12 barg / 174 psig
Flow	40...140 kg/min 88...308 lb/min

## Measurement Requirements

The dosing process requires accurate and reliable flow measurement. The measuring performance of the Coriolis mass flow meter that was previously installed was frequently affected by the presence of gas bubbles in the fluids. Given that polyol and isocyanate are viscous liquids, the air bubbles would have already been entrained during filling procedures or agitation. The existing two phase process flow dampened the vibration signal of the mass flowmeters.

Medium	Isocyanate
Density	1.3 kg/L / 81 lb/ft <sup>3</sup>
Viscosity	6500 cP
Temp.	25 °C / 77 °F
Pressure	12 barg / 174 psig
Flow	100...240 kg/min 220...529 lb/min

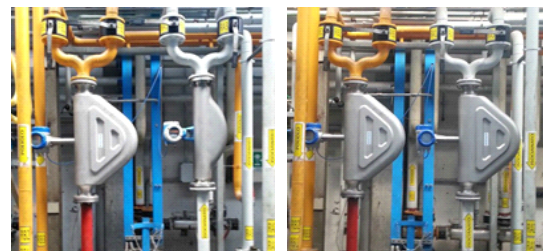
This dampening caused inconsistent sensor amplitudes. Whenever the resonance frequency could not be maintained, the devices “froze” at their last reliable readings. This triggered a process shutdown which not only brought the whole production process to a standstill but also required expensive cleaning of the pipelines. Only after the meters were restarted, could production be resumed. In order to master the impact of entrained air of around 5%, the plant decided to test a mass flowmeter featuring entrained gas immunity.

## The Ideal Solution - OPTIMASS 6400 C

The twin bent tube OPTIMASS 6400 C Coriolis mass flowmeter from KROHNE is immune to the effect of gas bubbles in the fluid. The Entrained Gas Management™ (EGM) feature is provided by the completely digital signal processing of the signal converter MFC 400 which allows for generating a known vibration frequency. The measuring tube oscillation is caused by this vibration, so the frequency of the measuring tube is also known precisely. This is also true in the event of gas bubble disturbance. The control loop remains 'clean' and is not disturbed by interspersed and amplified frequencies. In this way, the OPTIMASS 6400 accurately measures amplitudes and phases, even in disturbed conditions, and controls them in the resonance.

## Benefits

The OPTIMASS 6400 C was initially installed as a test device into the polyol pipeline, running in parallel operation with the existing device over a period of a few months. The observed results were more than satisfactory, and the existing device in the isocyanate pipeline was also replaced with the OPTIMASS 6400C. These devices remain in continuous measuring operation, even in the event of gas entrainment of up to 100% by volume in the fluids. Unlike other Coriolis mass flowmeters, the OPTIMASS 6400 C doesn't stall if gas fractions occur. The immunity to gas entrainment ensures there is no interruption in the dosing process due to the presence of gas bubbles.



OPTIMASS 6400 test device (left), installed in parallel with the existing mass flowmeter

The OPTIMASS 6400 installed in both pipelines

This mass flowmeter also features various diagnostic functions that indicate installation errors, temperature or density changes and a 2 phase threshold that can be set to output a status signal indicating the presence of gas bubbles in the process. This helps reduce unnecessary downtime.

The OPTIMASS 6400 C is also not sensitive to cross talk. Thus, if required, more than one meter can be installed on a single framework.

## OPTIMASS 6400 C

- Standard Coriolis mass flowmeter for the process industry
- EGMTM (Entrained Gas Management): Continuous measurement even at gas concentrations of up to 100% and sudden void rate changes
- For cryogenic and high temperature applications [-200°C...+400°C / -328...+752]
- Optional insulation / heating jacket
- Communication: HART®, FOUNDATION fieldbus™, PROFIBUS™
- Custody transfer applications: OIML R 117-1/MID MI-005 (liquids), OIML R 137/MID MI-002 (gases)
- ATEX, IECEx, FM, Gost etc.

