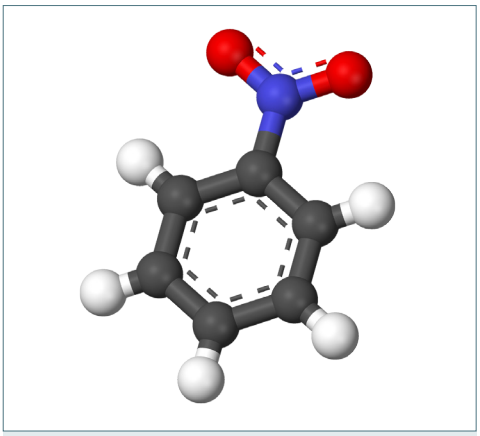
Highly accurate dosing of nitrobenzene

Application note A057-CM02-0716A

- Aniline production
- Solvent of paints and ethers

Nitrobenzene is a pale-yellow coloured organic compound with chemical formula $C_6H_5NO_2$. This liquid compound is mainly used as a precursor for the synthesis of the organic compound aniline, which, in turn, is a precursor for many industrial compounds.

Liquid nitrobenzene needs to be dosed with high accuracy in a chemical pilot plant in order to generate an optimised chemical end product. Before Bronkhorst became involved, the liquid was manually dosed with needle valves. There were however some issues with this procedure. The needle valves were not accurate enough, due to changes in temperature or pressure. The R&D engineers and operators of the pilot plant looked for a better solution, and arrived at Bronkhorst. After observing the mini CORI-FLOW demo case with flow software included, they decided to build a new dosing system with Bronkhorst equipment incorporated.



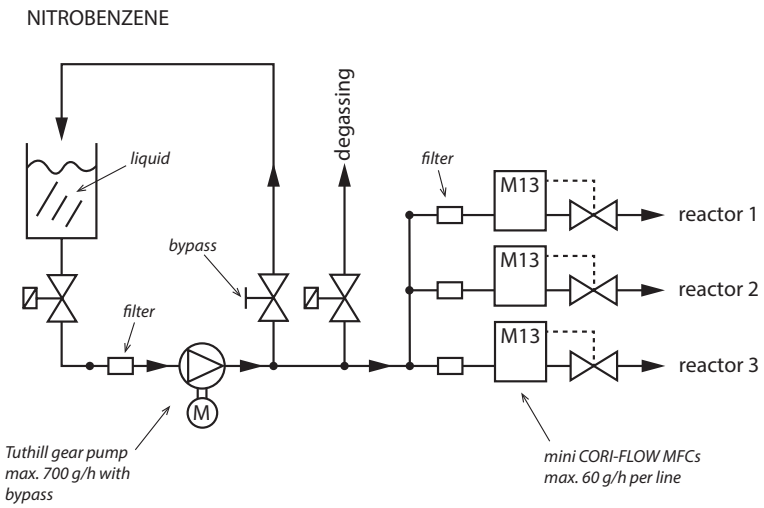
Nitrobenzene molecule

Application requirements

The reproducibility of the dosing solution for nitrobenzene should be better than ±0.5% of the reading. Furthermore, the dosing solution should compensate for variations in the process upstream of this solution, in order to obtain a stable flow of nitrobenzene.

Important topics
- Highly accurate and reproducible
- Compensating for varying process conditions
- Stability in dosing

Process solution



Flow scheme

The new nitrobenzene dosing system comprises a Tuthill gear pump, a degassing valve, three M13 mini CORI-FLOW mass flow controllers with filters and some additional equipment. The degassing valve between the gear pump and the M13's is necessary to tackle the problem of gas bubbles in the nitrobenzene liquid.

After successfully implementing this new dosing system, a repeatability of the measurement value for each M13 of ±0.1% of the reading has been obtained, well within the requirements. The pilot plant engineers and operators are highly satisfied with this solution.

However, prior to a successful implementation of the M13 mini CORI-FLOW mass flow controller, some conditions had to be fulfilled. At first, a vibration dampener has to be mounted below the mass blocks of each M13. Without such a dampener, an incorrect zero point is obtained. In addition to that these mass blocks were heated, to eliminate potential inaccuracies caused by temperature fluctuations. Furthermore, the pipe between the gear pump and the M13's has to be relatively short and straight. Too long, tortuous and too narrow pipes will result in pulsation and gas bubbles in the mini CORI-FLOW mass flow controllers. ■

Bronkhorst®

Recommended Products

mini CORI-FLOW Series M12-M14

The unique design of the miniature Coriolis sensor features unsurpassed performance, even with changing operating conditions in pressure, temperature, density, conductivity and viscosity. Contrary to many other Coriolis flow meters on the market, mini CORI-FLOW offers integrated PID control and close-coupled control valves or pumps

- Direct mass flow measurement, for liquids and gases
- High accuracy, excellent repeatability
- Cost-effective design
- Compact design, with integrated PID controller for fast and stable control
- Now suitable for (very) low flow ranges
- Digital technology allows fieldbus communication

mini CORI-FLOW Series ML120

The new Bronkhorst ML120 Coriolis Mass Flow Meters and Controllers offer highest performance at the world's lowest flow rates for both liquids and gases lowest range 50…5000 mg/h up to highest range 2…200 g/h The Coriolis sensor of the ML120 shows little to no variance over a long period of operation, thus reducing the system downtime.

- Direct mass flow measurement
- Fast response time
- High accuracy (0,2% Rd for liquids, 0,5% Rd for gases)
- Additional density and temperature outputs
- Compact design with very small internal volume
- Easy to install (low risk of gas bubble inclusion)
- Multi-range: easy on-site re-ranging via digital interface (span 1:4000)

mini CORI-FLOW Series M15

Bronkhorst Coriolis Mass Flow Meter model M15 is suited for flow rates between 0,2 and 300 kg/h. Similar to the models for lower flow rates, M15 has an integrated PID-controller and a batch counter for accurate dosing of liquids or gases. The instrument features a robust IP65 weatherproof housing, secondary output of fluid density and temperature, and "scalable range" functionality.

- Direct mass flow measurement
- Fast response time
- High accuracy
- Additional density and temperature outputs
- Compact design
- Excellent price/performance ratio
- Scalable range
- Insensitive for environment vibrations

Mounting parts

In order to guarantee the zero stability, (ultra) low flow Coriolis instruments need to be rigidly bolted to a stiff and heavy mass or construction. External shocks or vibrations should be avoided. For customer convenience, Bronkhorst offers a variety of mounting parts, e.g. mounting blocks and vibration dampeners.

- Available in various sizes for different models Coriolis flow meters/controllers
- Also suitable for combinations with pumps and valves
- Eliminates mechanical shocks and interference

Contact information

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CM: Chemical, Metal & Glass
02: Fine Chemicals