

LIQUEFIED GAS DOSING

"You know what you pump - in real-time."

Many chemical reactions that are conducted at high pressures require the supply of precise amounts of organic solvents, for example for extraction purposes. To replace traditional organic solvents, greener and more effective alternatives such as liquefied gases are considered. A liquefied gas is a gas at atmospheric pressure and room temperature, which is turned into a liquid by cooling or compression. As an example, liquefied carbon dioxide (CO₂) is an excellent extraction solvent for non-polar chemical compounds, or can be used for cleaning wafers. Moreover, liquefied propene and isobutane are used as solvents in the manufacturing of polypropylene (PP) and high-density polyethylene (HDPE).

Difficulties in handling these liquid/gas substances and lack of dosing precision have been typical obstacles for utilising liquefied gases in technical applications. However, by combining Bronkhorst Coriolis mass flow controllers with WADose high pressure pumps, a simple yet complete solution is available for dosing of low-flow liquefied gases.



Application requirements

Liquefied gases have to be dosed in the liquefied state to the relevant application, which operates at high pressures (up to several hundreds of bars). For accurate dosing of liquefied gases, the process conditions, especially pressure and temperature, have to be such that outgassing of the liquid will be avoided. Especially at low flows, it should be monitored that the required amount of liquid is actually dosed.

Important topics

- Avoid outgassing of liquids
 - Dosing at high pressures
 - Accurate measurement of dosed liquid with low flows
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Process solution

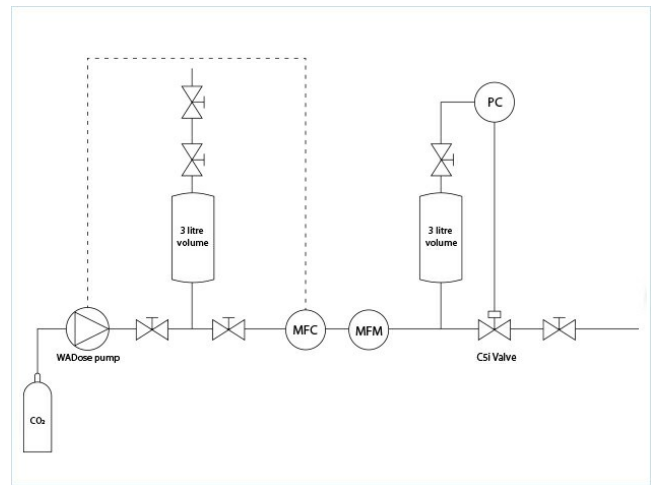
The process solution for dosing liquefied gases consists of a WADose HP Lite pump with an attached heat exchanger, combined with a Bronkhorst Coriolis mass flow controller and an EL-PRESS pressure meter. The function of the heat exchanger is to cool the pump head to below freezing temperature, in order to stimulate liquid forming and to prevent cavitation and outgassing. This to avoid pressure fluctuations and an unsteady liquid flow when dosing the chemical compounds. Flowbus is used as a standard communication protocol between the pump and the mass flow controller.

The combination of the WADose piston pump and the Coriolis mass flow controller allows for an accurate dosing of the liquefied gases. Stand-alone piston pumps are not hermetically tight and exhibit wear over time. Therefore, their setpoint may deviate from the real amount of chemical compound dosed, which is especially at stake when dosing low flows in the range of ml/min. In the current combination, the dosed quantity is accurately measured in-situ using the Coriolis mass flow controller, and this device controls the pump by adjusting the flow. This self-monitoring control circuit works continuously, making sure that the solution doses what it should do, so that 'you know what you pump' in real-time. Prior to using this solution, the supply of liquefied gases typically occurred uncontrolled, thus lacking necessary precision.

This process solution boosts liquefied gas, typically from a gas cylinder, into a liquid at a higher pressure of about 200 bars. The pressure is monitored by a digital electronic pressure meter - for measuring the process pressure as well as for safety functionality. This is to be sure that the pressure does not get higher than the devices or vessels in the process can withstand, to protect those components. No extra safety relief valves are necessary in this way.

In addition to the mass flow rate - which is fluid-independent - the mass flow controller also continuously measures the density of the chemical compound. This is an extra measure of monitoring whether or not the compound is fully in its liquid state - and to which can be responded immediately. Also the temperature of the dosed compound is monitored by the mass flow controller.

This pump/controller combination is a complete plug-and-play solution without any engineering hours needed to be spent. Control parameters are easy to modify using the intuitive interface.



Flow scheme

Recommended Products



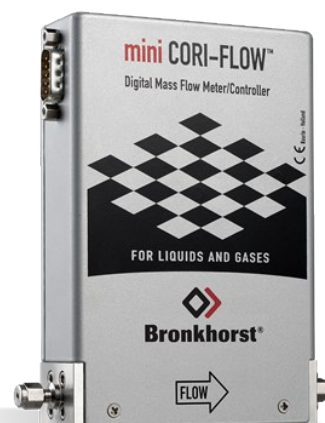
MINI CORI-FLOW™ M13

Min. flow 1...50 g/h
Max. flow 20...2000 g/h
Pressure rating 200 bar
Independent of fluid properties
High accuracy, fast response



EL-PRESS P-502C

Min. pressure 2...100 mbar
Max. pressure 1,28...64 bar
Absolute or gauge pressure
High accuracy



MINI CORI-FLOW™ ML120V00

Min. flow 0,05...5 g/h
Max. flow 2...200 g/h
Pressure rating 200 bar
Independent of fluid properties
High accuracy, fast measurement



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