EQUILIBAR
PRECISION PRESSURE CONTROL

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Integrated Lab Solutions, Gmbh Successfully Uses Equilibar® Back Pressure Regulator For Challenging Study of Hydrofluoric Acid Phase Equilibria

As part of an advanced thermodynamic study by a chemical manufacturer, Equilibar's ZF Zero Flow back pressure regulator was custom fabricated from Hastelloy C4 and Kalrez o-rings to withstand exceptionally corrosive hydrofluoric and sulfuric acid mixtures.

Background

Integrated Lab Solutions (ILS) in Germany, an innovative supplier of high-throughput research systems, has designed a novel method for studying phase-equilibria of binary mixtures of water and HF as well as tertiary mixtures of HF, water and sulfuric acid.

The system includes a calorimeter function, which makes it possible for the user to identify conditions at which a mixture begins to boil. Quantitative measurement of the heat of vaporization is also possible.

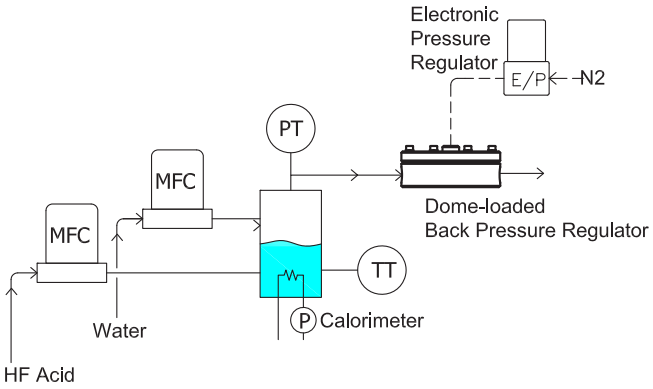

Figure 1: Schematic showing a simplified version of the test system used by Integrated Lab Solutions, Gmbh using the Equilibar® back pressure regulator

Application

ILS designed this unique system for a client who needed to optimize HF-water separations by distillation, a particularly challenging problem because HF and water form stable negative azeotropes. The system relies on an Equilibar ZF Zero Flow back pressure regulator fabricated from materials designed to perform in acidic conditions.

Using proprietary internals, the ILS process generates an equilibrium mixture and automatically removes sub-milliliter quantities of distillate bottoms and condensate over a wide range of temperatures and pressures. Tight pressure-control is essential as the azeotropic behavior of HF-water mixtures is a function of total pressure.

"The Equilibar back pressure valve is unique in its ability to control the very low flow rates and extreme corrosivity of the HF-water vapors we encounter in this very challenging system," said Dr. Anton Nagy, founder of ILS.

Nagy noted that an additional advantage of the system is that the C4-Hastalloy valve could be custom fabricated in a shorter time frame than other valves. Most acidic and corrosive applications can be satisfied by Hastelloy C276, which Equilibar keeps in stock to meet customer demands.

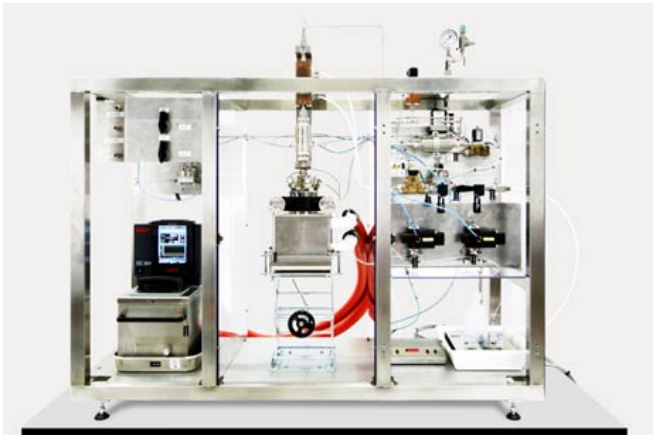

Figure 2: Hydrofluoric Acid research system built by Integrated Lab Solutions with the installation of the Equilibar® regulator.

ZF Series Attributes

The ZF Series works in a completely unique way, with the valve seat accomplished by using a floating o-ring wrapped around a floating ring support hub. This design is especially useful where flow rates fall to zero and pressure retention and flow resumption without hysteresis are also required.

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For example, the ILS application uses a pressure range up to 30 bar, with the ZF BPR controlling the solution pressure accurately to within 0.1 bar using closed-loop control.

In addition to using a Hastelloy C4 diaphragm and support hub, this system utilizes a DuPont Kalrez 6375 FFKM o-ring to resist the severe acidic environment. While many Equilibar regulators use a PTFE diaphragm, the company's engineers were able to source the Hastelloy C4 foil to meet the specific customer requirements.

According to Nagy, the benefits of the system are notable: "The extremely broad turndown of the Equilibar means that the ILS client has virtually unlimited flow and pressure-variation flexibility over the ranges of interest for these studies."

Figure 3: The hydrofluoric acid back pressure regulator used in the ILS research system

Figure 4: Equilibar's ZF floating o-ring and hub

Contact Equilibar

Equilibar is a provider for unique and innovative pressure control solutions based in Fletcher, North Carolina. The patented back pressure technology is used in a wide array of processes including catalyst, petrochemical, supercritical and other industrial applications. For more information please contact an Equilibar applications specialist at www.equilibar.com or 828.650.6590.

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