

Reducing Charge and Increasing Efficiency with Vapor Quality Control

With Vapor Quality Control and Liquid Level Sensors, a German cold store more than halved its ammonia charge and reduced energy consumption by 24%, compared to a traditional pumped overfeed system.

A refrigeration facility in northern Germany faced challenges implementing a centralized DX ammonia refrigeration system. With customers frequently running partial loads, the operator and consultants were struggling to find an efficient solution to avoid flooded evaporators and wet suction lines.

The cold store operator needed a three-stage system, with suction temperatures at -42°C for blast freezing, -32°C for cold storage and -10°C for the docks. The operator also required heat recovery for underfloor heating and an air curtain application. The facility's cold rooms have a total volume of $92,805\text{m}^3$ and the system was designed with hot gas defrost and 19 evaporators in total.

Why Vapor Quality Control?

A Vapor Quality Sensor from HB Products allows you to maximize the performance of your evaporator by providing a direct, real-time measurement of the evaporation process. It offers precise insights into what's happening within the pipes, functioning like an electronic sight glass to monitor liquid levels accurately.

The signal from the sensor can then be used to control the expansion valve in a DX system and optimize evaporator operation. The sensor protects the compressor and eliminates the need for superheat control, significantly improving the energy performance of the system.

The original design proposal in Germany was for a traditional pumped overfeed system and specified an ammonia charge of 5 tonnes. By implementing Rod Style Sensors from HB Products on each evaporator, a more efficient DX system with less than half the ammonia charge (2.2 tonnes) could be installed instead.

The operator was convinced to try this new approach, and the company has been so pleased with the results, that they have expanded the use of ammonia DX refrigeration systems with HB Products sensors to other facilities.

After two years of **very reliable operation**, the DX facility with Vapor Quality Control and Liquid Level Sensors operates with a Specific Energy Coefficient of $36\text{kWh}/\text{m}^3/\text{year}$. This is **24% less**



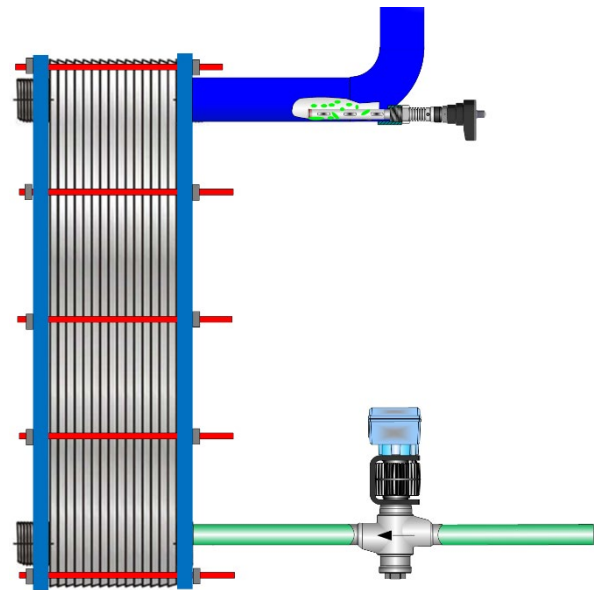
energy than a similar facility with a liquid overfeed system, located in the same area and owned by the same operator (47kWh/m³/year).

A key take-away for the operator has been where to locate the sensors. To ensure accurate readings, it is essential to avoid contact with welds, as delays in sensor measurement and processing can impact liquid feed control and potentially cause evaporator coil flooding. Verification of sensor installation and calibration is also important to ensure maximum accuracy.

Which sensors?

After consulting with HB products representatives, the German operator chose a Rod Style Sensor. This sensor is unique in that it measures the liquid inside the sensor element itself, not between the inner element and the pipe walls. It must therefore be placed where the liquid flows at the bottom of a horizontal pipe, typically in an elbow with the sensor element at the lowest point. It works with a range of fluids and has a split design, where electronic parts can be removed with a finger screw, simplifying installation and diagnostics. It is available for pipes from 50 mm to 200 mm.

For liquid level measurements, the operator chose a flexible Wire Sensor with lengths ranging from 250 mm to 6.000 mm. This is a flexible capacitive sensor built with a 1,5 mm insulated stainless steel wire. It can therefore withstand high pressure and low temperatures, providing a reliable and durable solution. Like the Vapor Quality Sensor, it has a split design, enabling easy installation and diagnostics.



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