ON THE BLUE, BLUE DANUBE

A visit to Ferrexpo Port Services in Vienna, Austria
Measuring instruments: DMA 4500 M and DPRn

It is usually not a big deal for the driver of a motor vehicle to pull over and refuel when the fuel warning light indicates that it is time to do so: most likely the next gas station is conveniently located around the corner and the tank filled long before the last drop of fuel is consumed. But what does the captain of an inland waterway transporter do when the ship is running low on fuel? Easy enough: he directs the vessel towards the next bunker station.

The Danube: Habitat and Transportation Route

As early as the beginning of the seventeenth century, the Danube was traveled on by vessels. Today it still serves as a way of transportation for people and cargo. In central Vienna, on Handelskai, there is a bunker station called "Ferrexpo Port Services" which provides fuel to inland waterway vessels. In addition to the bunker station, the Ferrexpo has two small mobile bunker boats at its disposal with a fuel capacity of around 300 tons. These bunker boats deliver directly to cabin vessels in the Vienna area.

For legal reasons, the delivery and dispense of the fuels may only take place on the water. The bunker station itself consists of two separate ships: one is the fuel station from where ships are supplied with the necessary fuel, and the other is the storage tank that receives and holds the fuel which is subsequently transferred to the fuel station by means of a pipeline. In this way, deliverers and customers do not get in each other's way should they call at the Ferrexpo Port Services at the same time.

The Right Fuel for Each Season

Seasonal diesel compositions apply for ships as well as for cars. This variation in fuel composition also influences the fuel's price as the change in temperature goes hand in hand with a change in density of the fuel. As a consequence, the determination of the fuel's volume alone is not sufficient to calculate the correct price for the temperature-dependent volume of the delivered fuel.

Not only seasonal temperature fluctuations affect the factors that have to be considered when calculating the fuel's price: the fuel is stored in a floating tank that is partially immersed in water. As a consequence, additional temperature gradients apply caused by the temperature of water plus the ambient temperature. On top of that, with each fuel dispense or delivery the changes in fill height in the tanks also have to be considered.

Considering all these factors, how does Ferrexpo ensure that delivered as well as dispensed fuel quantities are being measured and priced independently of the prevalent temperatures?

Ferrexpo answers this question professionally!

Continuous Insight for Correct Dosage

In 2011, Ferrexpo purchased a DPRn measuring cell with density sensor for the continuous measurement of density and temperature during fuel delivery and fuel dispense and also, for measurements in the laboratory, a DMA 4500 M density meter by Anton Paar. From that time on, seasonal fluctuations did not impose a problem anymore. Ever since the acquisition of these measurement devices, dispensed quantities can be measured correctly and effortlessly. "We continuously measure temperature and density with DPRn," states Bernhard Benkovits, CEO of the Ferrexpo Port Services GesmbH.

Fuel continuously flows through the measuring cell with its built-in density sensor (see Figure 1).

The temperature is also measured and is, together with DPRn's frequency signal, transferred to an mPDS evaluation unit. This unit is conveniently mounted in the office and can be operated directly from there as can be seen in Figure 2. On the mPDS screen, the density and the density at a reference temperature or density-derived quantities such as concentration are displayed.

The DMA 4500 M density meter (see Figure 3) delivers fast and accurate measurement results in a wide viscosity and temperature range and is ideally suited for highly precise density measurements and for adjusting the DPRn measuring cell.

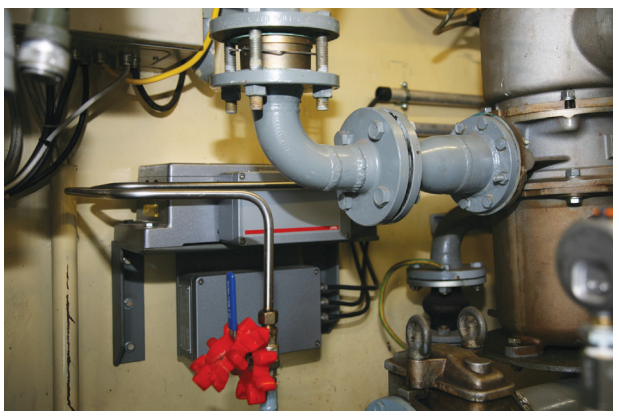


Figure 1. DPRn measuring cell with density sensor

"The dosed quantities are measured at the actual temperature by means of a flow meter. According to ASTM Table 53 b and 54 b the quantities are converted so they correspond to the respective quantity at 15 °C. At delivery, we also measure the current density value with DMA 4500 M," states Benkovits.

Always on the go for Their Clients

The fuel price is always calculated according to the daily market price. With accurate density measurements a fair calculation is always guaranteed: Looking at quantities from 1000 to 1200 metric tons per week Ferrexpo achieves a deviation between delivered to dispensed fuel that is is well below a tenth of one percent! In order to maintain the constant supply of fuel, the bunker station is operated in shifts around the clock most of the year.

Figure 2. The mPDS evaluation unit can be operated from the office

Safety for Humans, Animals and the Environment

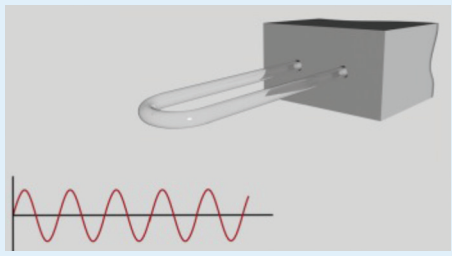
The protection of employees as much as legal requirements for environment and navigation characterize the careful handling of fuels. The legal requirements for fuels used for inland waterway vessels in Austria are very strict, but are meticulously adhered to by Ferrexpo. The fact that swans have made their home in the vicinity of the bunker station is testimony to this.

Figure 3. The DMA 4500 M density meter

How Density Measurement Works

Sample flows through or is filled into the U-shaped tube of the DPRn and DMA 4500 M density measuring devices, respectively.

This U-shaped tube is electronically excited to oscillate. If the sample's density is low, as is the case with e.g. air, the U-shaped tube oscillates with high frequency.

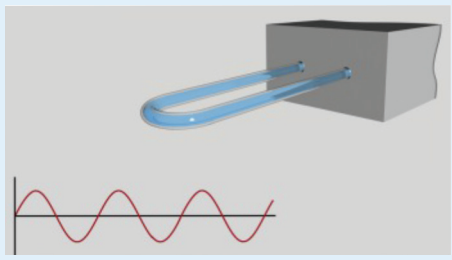


If the density of the filled in sample is higher, for example water, the U-shaped tube oscillates with lower frequency.

The characteristics of the oscillations are measured and the frequency signals are recorded.

In laboratory density meters such as DMA 4500 M, a built-in reference oscillator makes it possible that one single adjustment at 20 °C is sufficient for the entire measuring range.

The density is determined highly accurately, deviations of the measurement result caused by thermal stress implied with the U-tube are compensated, and viscosity-related errors corrected.



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