

Dynamic flow measurement in the Rhine port of Birsfelden

Swiss-precision ship unloading for custody transfer applications



With a capacity of approx. 165,000 barrels per day, VARO is an established, experienced and reliable refinery operator, producing kerosene, petrol and diesel for passenger vehicles, and heating oil and asphalt for the road construction industry. VARO currently has a tank farm capacity of 2,810 million m³ across 47 sites in five countries, and a terminal network (including tank farms) that extends across Switzerland, Germany, the Netherlands, Belgium and France.

„Through the use of Endress+Hauser's flowmeter technology, we have greatly increased our flexibility in relation to the transfer of products to storage and inventory management.“

Hubert Himmelspach
Maintenance Project Manager



Promass 84F at an unloading system



Unloading a ship in the Rhine port of Birsfelden

Approximately 250 tankers dock here each year at the two mooring stations located at VARO Energy Tankstorage AG in the Rhine port of Birsfelden. Endress+Hauser's flowmeter system has made it possible to speed up the unloading process and to record the load volume accurately and in real-time during unloading.

The customer's requirements

The unloading process takes around 8 hours. Depending on the water level of the Rhine, approx. 2,500 m³ of mineral oil products are stored per ship. VARO was looking for a partner to design a system solution that would enable direct, high-precision, custody-transfer measurement of the quantity being put into storage, so that any shortfalls could be detected immediately. Due to the very tight space restrictions, the flowmeter system had to be extremely compact.

The solution Endress+Hauser developed a complete solution based on high-precision Coriolis measuring technology, which meets the requirements of a modern tank farm. This

involved planning, detailed engineering, production and delivery of all components and measuring devices, onsite calibration and commissioning. The system was supervised and optimized by Endress+Hauser in the course of over 300 shipments. Final acceptance of the system by NMI Certin BV (the national calibration authority in the Netherlands) was more than enough to convince VARO.

Benefits

- Real-time control measurement of the delivery volume
- Direct addition during transfer to storage
- Time-savings due to faster results compared to tank level measurement
- Increased flexibility during transfer to storage and inventory management
- System suitable for custody transfer in accordance with MI-005 certification
- Compact installation, since the flowmeter system does not require a deaerator

Delivery volumes are still often measured on the basis of tank measurements. However, this traditional method is prone to errors, for example during level-volume-mass conversion and due to inaccurate tank level readings caused by foam or turbulence on the surface of the medium while it is being transferred to storage. Endress+Hauser has developed an unloading system based on high-precision Coriolis measuring technology, which is capable of measuring even two-phase mixtures (hydrocarbons + air).

Due to the process involved, the product can at times contain a mixture of liquid and air. This typically occurs at the start of the unloading process (empty pipe) and when the individual shipping tanks are being drained using suction. These phases involving air-laden fluids can cause significant measuring errors in flowmeters. For this reason, deaerators are often installed upstream from the flowmeter. Endress+Hauser's unloading system has a second measuring mode, which enables accurate measurement of two-phase fluids too, thus eliminating the need to install large, expensive deaerators.

In addition, process parameters such as pressure, temperature and density can be recorded, and supplementary diagnostic parameters are available to detect the entry of air. The measurement results are stored in

the system and can be printed on a ticket printer (classified as an original document).

Promass 84F Coriolis flowmeter

The main component of the unloading system is a Coriolis precision flowmeter, type Promass 84F, with a nominal diameter of DN250. The Promass meets the requirement of the 0.3% accuracy class defined in OIML R117-1.

Cerabar PMP71 pressure sensors

Using both pressure sensors creates a secondary measuring mode, which is used in the case of unstable process conditions caused by a mixture of mineral oil and air.

Omnigrad TR66 temperature sensor

An additional temperature sensor measures the medium temperature and is used to calculate the reference density required to convert from mass to standard volume at 15°C.

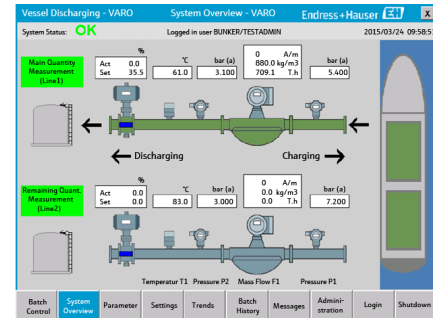
Butterfly valve

A butterfly valve enables rapid filling of the empty pipe between the ship and the unloading arm and therefore ensures stable measuring conditions. The butterfly valve is controlled fully automatically via the unloading computer.

Offloading flow computer SBC600

This computer is the "switching center" of the entire unloading

measurement system. It records the field instrumentation measurement data, analyzes these signals and converts them into information on the quantity unloaded, which can then be used for custody transfer purposes.



User interface of unloading computer

✓ Scope of delivery

- Promass 84F Coriolis flowmeter
- Cerabar PMP71 pressure sensor
- Omnigrad TR66 thermometer
- Butterfly valve
- SBC600 unloading computer
- Planning
- Detailed engineering
- Onsite calibration
- Commissioning

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