



APPLICATION REPORT

Oil & Gas

Ultrasonic flow measurement of hydrocarbon vapors

- Ultrasonic flowmeters for a vapor processing and cleaning unit at a terminal
- Flow measurement of low-pressure gases from storage tanks
- Monitoring of liquid vapors with high variations in gas content
- Bidirectional measurement over a large dynamic measuring range



1. Background

New laws and regulations require terminals to collect and process vapors released during the storage and transfer of refined hydrocarbons such as fuel oil. Koole Tankstorage Minerals (KTM), an independent international storage and transport company, has designed a new vapor processing unit to keep emissions at their tank terminal in Pernis, the Netherlands, well below the legal emissions threshold.

2. Measurement requirements

The unit is designed to process and treat all vapors extracted from the fuel oil tanks. The cleaned vapors end up in the incineration section where they are flared off in a fully autothermal process without using any additional fuel gases.

During the loading and unloading procedures, the vapors are extracted and transported to the vapor processing unit with blowers at almost ambient pressure conditions. The vapor composition depends on how the liquid hydrocarbons are stored, pumped or transported. Due to temperature changes, the gases can contain moisture or even liquid drops. Tanks may be rendered inert by means of gases like N_2 or even CO_2 to prevent hazardous conditions or product oxidation during transport, which in turn also has an impact on the vapor composition. The vapor flow rates can vary greatly. If products are not moved, the flow velocity is very low. When numerous seagoing vessels are loaded or unloaded at the same time, however, vapor flow rates can rise steeply.

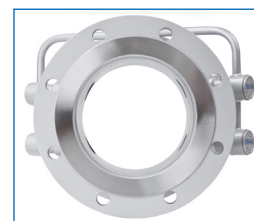
To control the system and check continuously on leakages, it is important that every vapor entry point is monitored by a flowmeter. The customer was therefore searching for a flowmeter able to measure the vapors extracted from the fuel oil storage tanks over a wide dynamic range. It was required that pressure drops be avoided. Bidirectional measurement was mandatory for the various measuring points. As the vapor processing unit must always be available and operational, low maintenance or long calibration intervals of the flowmeter were considered crucial.

KROHNE

3. KROHNE solution

KROHNE supplied several OPTISONIC 7300 ultrasonic gas flowmeters for the vapor processing unit. The OPTISONIC 7300 is ideally suited for flow measurement of vapors and gases over a large dynamic range and largely independent of gas density and composition.

Following initial calibration, the device provides accurate measuring results over time. The standard measuring range is between -30 and 30 m/s within a performance of $\pm 1\%$ for flow rates > 1 m/s. The gas flowmeter features a full-bore design without any moving or intruding parts, thus causing no pressure loss.



Full bore design of the OPTISONIC 7300 ultrasonic flowmeter



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4. Customer benefits

The air emitted is now in fact clean and hydrocarbon emissions are also minimized significantly, demonstrating the potential of KTM's sophisticated solution. With the use of the OPTISONIC 7300 flowmeter, the storage company always knows how much vapor is coming from where. In this way, the vapor processing unit can be effectively monitored and controlled. Next to the dynamic flow rate, the gas velocity of sound can also be continuously measured and provided by the KROHNE flowmeter via a second output. Since the mol weight is directly proportional to the velocity of sound, it can be calculated and used by the customer to optimise the burning process.

KTM benefitted from KROHNE's long-lasting application expertise in ultrasonic gas flow measurement. Not only are the algorithms of the OPTISONIC 7300 optimised for those difficult process conditions, also the acoustic transducer frequency was optimised for this application to maximise signal strength leading to a highly reliable measurement at the almost ambient pressure conditions.

The OPTISONIC 7300 also meets the customer requirements for plant availability. The ultrasonic flowmeter remains drift-free over time and impact of liquid droplet and CO_2 concentration are minimal. The flowmeter is maintenance-free by design. A periodical recalibration is not required. Wear or restrictions in terms of dynamic measuring range are also not an issue.

5. Product used

OPTISONIC 7300 C

- Ultrasonic flowmeter for hydrocarbon vapors and other gases
- High accuracy ($\pm 1\%$ of MV), independent of gas composition
- Large dynamic range (turndown ratio: 100:1)
- Maintenance-free, no pressure loss, no need for periodical recalibrations



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Would you like further information about these or other applications?
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