

Entrained air in bunkering

Accurate fuel measurement with mass flow metering solutions

Benefits at a glance

- **Cost savings:** Avoid extra costs for fuel mixed with air
- **High accuracy:** Coriolis technology provides precise mass flow and density measurement
- **Reliability:** Robust design for harsh marine environments
- **Compliance:** Meets international standards for bunkering measurement
- **Transparency:** Clear, auditable data for both parties



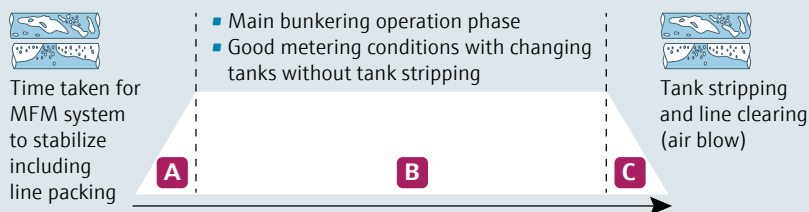
Ensure transparency in marine fuel transfers with Endress+Hauser patented advanced air compensation technology.

Summary Bunkering is the process of refueling vessels. The fuel is needed for running the main engine (propulsion) and the auxiliary engines (producing energy). Accurate measurement during bunkering is critical because even small discrepancies can lead to significant financial losses. One common challenge in bunkering operations is the presence of entrained and introduced air in the fuel stream.

Challenge Entrained air refers to air bubbles mixed within the fuel during transfer. The highest occurrence

typically happens at two critical stages: the beginning of fueling, known as “packing,” when fuel is first introduced into the line, and the end of fueling, referred to as “stripping,” when air is introduced to ensure complete fuel transfer. These stages present the greatest potential for air-related issues and are generally the most challenging. Additionally, entrained air can result from factors such as agitation or pump cavitation. While the air cannot be physically removed during bunkering, it still occupies volume in the pipeline. Traditional flow measurement (non-MFM)

Flow dynamics of a bunker process



systems often interpret this volume as fuel, leading to inaccurate readings and extra costs for fuel that is not actually delivered. For ship operators and fuel buyers, this means paying for air instead of energy – an expensive and avoidable issue.

Our solution Endress+Hauser offers a proven and patented solution to this challenge: the Mass Flowmeter Bunker Meter Solution, designed specifically for bunkering applications. This system consists of:

- Cerabar PMP71B pressure transmitters
- Proline Promass F Coriolis flowmeter
- TR66 explosion-proof Pt100 thermometer
- Bunkering Metering Computer SBC600

The Promass F Coriolis flowmeter is at the heart of the solution. Unlike conventional volumetric meters, Coriolis technology measures mass flow and density, enabling it to detect the presence of entrained air in the fuel. When air is present, the density of the mixture changes. The system

compensates for this variation, ensuring that only the actual fuel mass is accounted for in the transaction.

Although air cannot be completely eliminated from the fuel during bunkering, the skid is equipped with Endress+Hauser's patented system, which detects and compensates for entrained air in real time – maintaining an overall accuracy of 0.5%. Endress+Hauser's Bunkering Metering Computer SBC600 uses real-time data from the Coriolis flowmeter, pressure and temperature sensors to calculate accurate fuel delivery. This ensures compliance with international standards and provides transparency for both suppliers and customers.



Results Implementing the Mass Flowmeter Bunker Meter Solution delivers immediate and measurable benefits:

- Accurate fuel measurement even in the presence of entrained air
- Prevention of financial losses due to overbilling
- Improved trust and transparency between fuel suppliers and vessel operators
- Compliance with industry regulations for custody transfer

By detecting air and fuel separately, the system ensures customers pay only for the energy received – not for air bubbles.

Endress+Hauser backs its technology with a global network of local sales and service representatives. Wherever your operations take you, our experts are ready to assist with installation, calibration and ongoing support.



Contact your local representative today to get started



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