ExxonMobil

A leader in fuel measurement practices

Energy lives here™

Leading the way in next-generation marine fuel measurement

In 2012 in Singapore, ExxonMobil was the first fuel supplier to introduce an MFMS accredited by a marine port authority.

Following its success, ExxonMobil has now introduced a mass-flow metering system (MFMS) in Hong Kong where it has been independently certified by Lloyd's Register using the expertise of Metcore International and the National Metrology Centre of Singapore — a first for the market.

Rather than measuring volume, an MFMS uses the Coriolis effect at the heart of an automated process that monitors the mass flow, density and temperature of bunker fuel deliveries. This provides vessel operators with a refuelling process that offers transparency and increased efficiency when compared with traditional manual measurement methods.

ExxonMobil was:

- First to market with a port authority approved MFMS
- First to guarantee delivery by an MFMS in Singapore
- First to deliver more than 1 million tonnes via an MFMS
- First to launch an independently accredited MFMS in Hong Kong

Significant industrywide benefits

Mass-flow metering system technology provides a wide range of benefits to vessel operators, marine industry suppliers and regulatory bodies. These include:

- Enhanced transparency — expanded measurement uncertainty of the MFMS is less than 0.5 percent.
- Increased efficiency — measuring fuel mass directly reduces uncertainties associated with density, temperature and other factors such as tank geometry.
- Significant cost benefits — MFMS can save an estimated US $3,000[1] per delivery.
- Major time savings — the system offers the potential to save up to three hours per delivery.[2]
- Improved traceability — measurement data is logged throughout the entire delivery process, illustrating the fuel mass transferred at any point in time, and offering a transparent and accurate measure of delivered fuel.

A secure and reliable measurement solution

Enhancing the integrity and security of the measurement process, ExxonMobil's approved MFMS provides vessel operators with a fuel measurement solution they can trust.

- Mass flow meters are calibrated in line with OIML R117 and ISO 17025 standards and are independently validated and sealed.
- Systems have no flow bypass after the meter, and any bypass systems on ExxonMobil bunker tankers are blanked off and sealed.
- The MFMS's associated pipelines, valves, gauges and barge equipment are sealed and their security certified by independent parties.
- The meters are subjected to periodic calibrations and zero verification.
- Information systems are secured via a sealed transmitter and measurement tickets are printed via a designated secure printer.
- Buyers can examine meter totaliser records and can check to ensure the meter's security is intact using a seals checklist.
- Stringent practices ensure that ExxonMobil's MFMS are maintained to a consistent standard irrespective of location. This is independently verified by the port authority in Singapore and Lloyd's Register in Hong Kong.

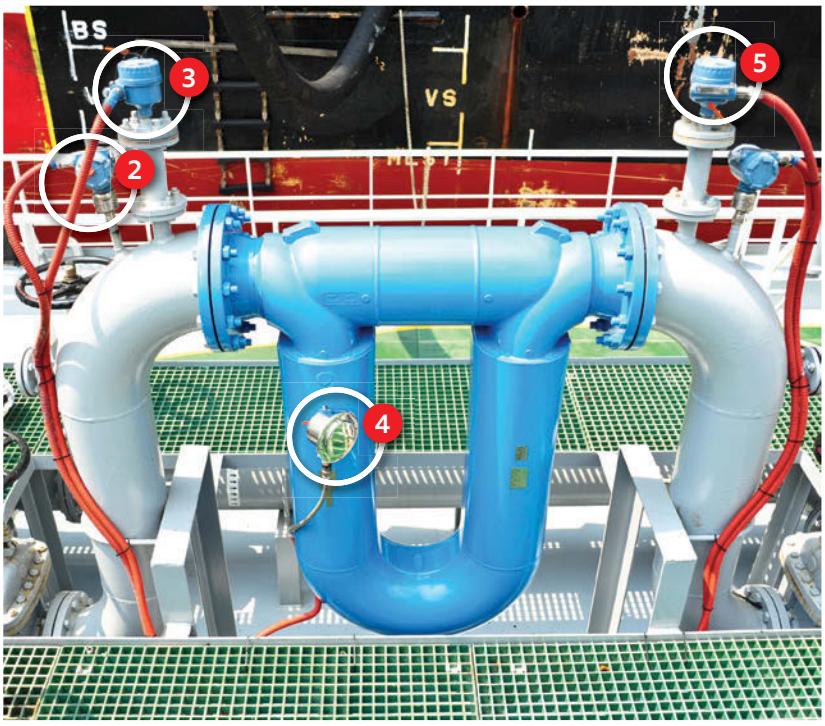
[1]Per 1,000MT stem size delivery at $300/MT. Includes surveyor costs, temperature delivery range and density delivery range but does not include dip tank measurement errors. A temperature measurement delta of 10°C amounts for up to US $2,100. A 3kg/m^3 density difference amounts for up to US $1,000. These variables can be avoided by the use of a secure mass flow metering system.

[2]Comparison versus tank gauging.

Security seals help ensure system integrity

Physical seals with unique numbers for all critical elements verify system security and guarantee traceability.

Stainless steel wires are sealed with unique identifiers for security and peace of mind.



Seals act to reassure the system's security.

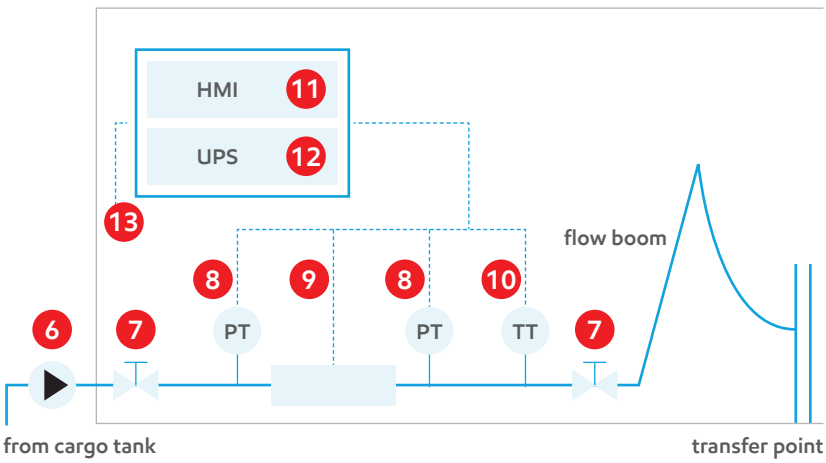
Physical seal locations:

1 Transmitter
2 Pressure transmitter
3 Upstream liquid detector
4 Enhanced core processor
5 Downstream liquid detector

System components:

6 Pump
7 Gate/isolation valve
8 Pressure transmitter
9 Coriolis flow meter
10 Temperature transmitter
11 HMI — Human Machine Interface
12 UPS — Uninterrupted Power Supply
13 CP — Custody Printer

Typical schematic diagram of MFMS for delivery

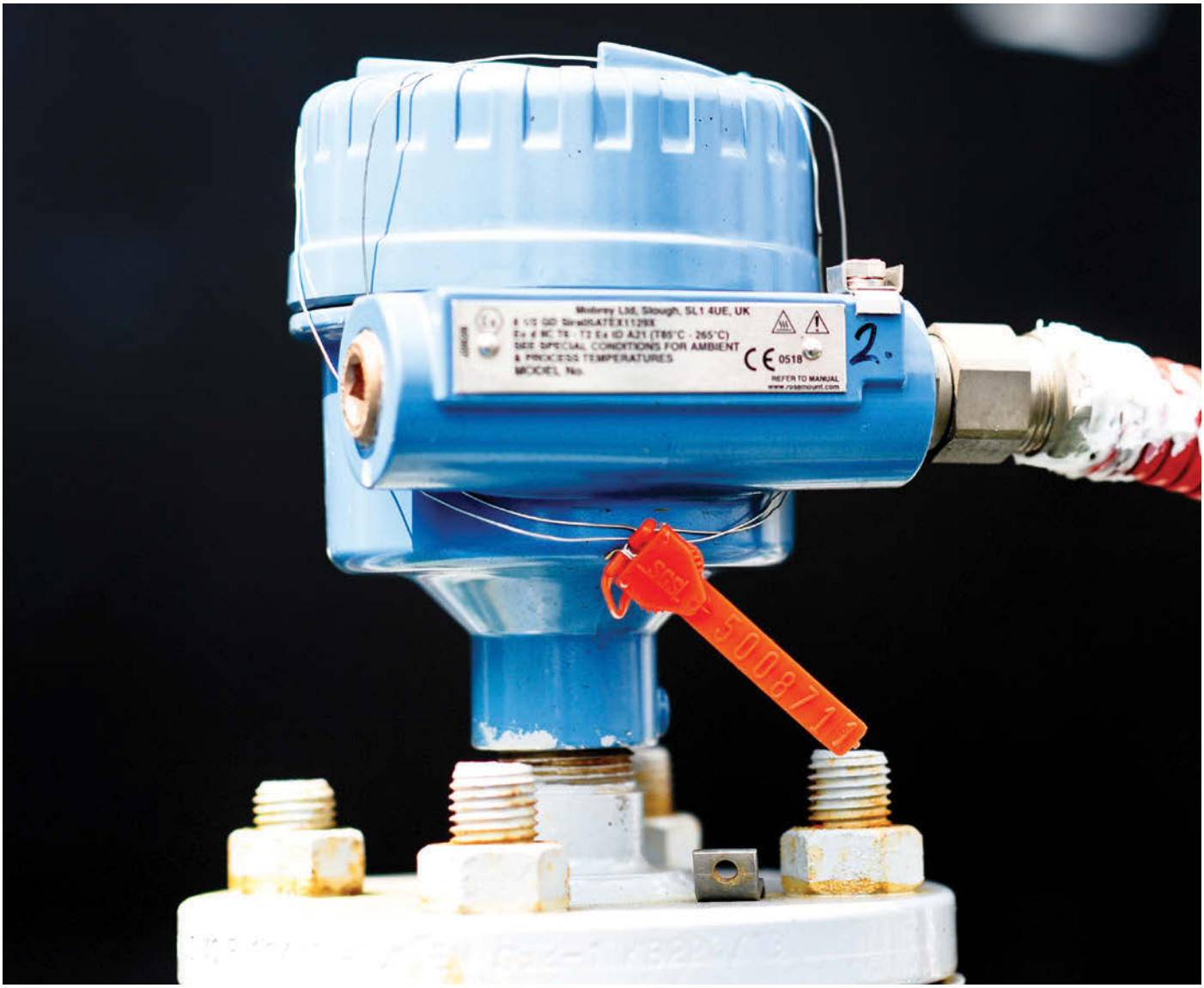


Photos contributed by Hong Lam Marine.

Measurement you can count on

The mass-flow metering system, with its added security measures combined with technological improvements, displays the necessary characteristics of a good measurement system.

Good measurement practices	Mass Flow Metering System
Accurate	✔
Approved by the authorities and certified independently	✔
Secure	✔
Transparent	✔
Saves time	✔
Cost effective	✔



Truly transparent business

We pride ourselves on our open and ethical business practices. We are continuously improving the integrity of our measurement techniques and are implementing advanced metering technology — so you can always see exactly what you're getting.

Our offices

Asia Pacific
Singapore
Phone: +65 6885 8998
email: ds-f&l-ap-marine@exxonmobil.com

Europe
Antwerp, Belgium
Phone: +32 3 543 3791
email: marine.fuels@exxonmobil.com

Americas
Houston, Texas, USA
Phone: +1 832 624 8132
email: emmf@exxonmobil.com

ExxonMobil

exxonmobil.com/marine