



THE MECHANICS AND JUSTIFICATION FOR BUNKER METERING

Chris Hill

North American Business
Development Manager



EMERSON
Process Management

Emerson At-A-Glance

2014 Key Facts

FOUNDED
1890

HEADQUARTERS IN
ST. LOUIS, MO
USA

DIVERSIFIED GLOBAL MANUFACTURER
AND TECHNOLOGY PROVIDER

OUR PEOPLE

115,000+
WORLDWIDE

\$24.5
BILLION
IN GLOBAL SALES

58
YEARS

CONSECUTIVE
YEARS OF
INCREASED
DIVIDENDS

2014 RECOGNITION

#121
AMONG
FORTUNE 500
OF AMERICA'S LARGEST
CORPORATIONS

FORTUNE
WORLD'S MOST
ADMIRED
COMPANIES

THOMSON REUTERS
TOP 100 GLOBAL
INNOVATORS

GLOBAL MANUFACTURING
AND SALES PRESENCE

150+

COUNTRIES

220

MANUFACTURING
LOCATIONS

NYSE:
EMR

Pioneer for Coriolis Technology

First Commercial Coriolis in 1977
Over 1 Million meter units sold



1,400 Flow Team Members Globally



Largest Engineering, Manufacturing
and Calibration Systems Worldwide
in Asia Pacific

Widest variety of sizes, geometries,
and performance options



ELITE Series
Peak Performance



F-Series
High performance compact
drainable



H-Series
Hygienic compact drainable



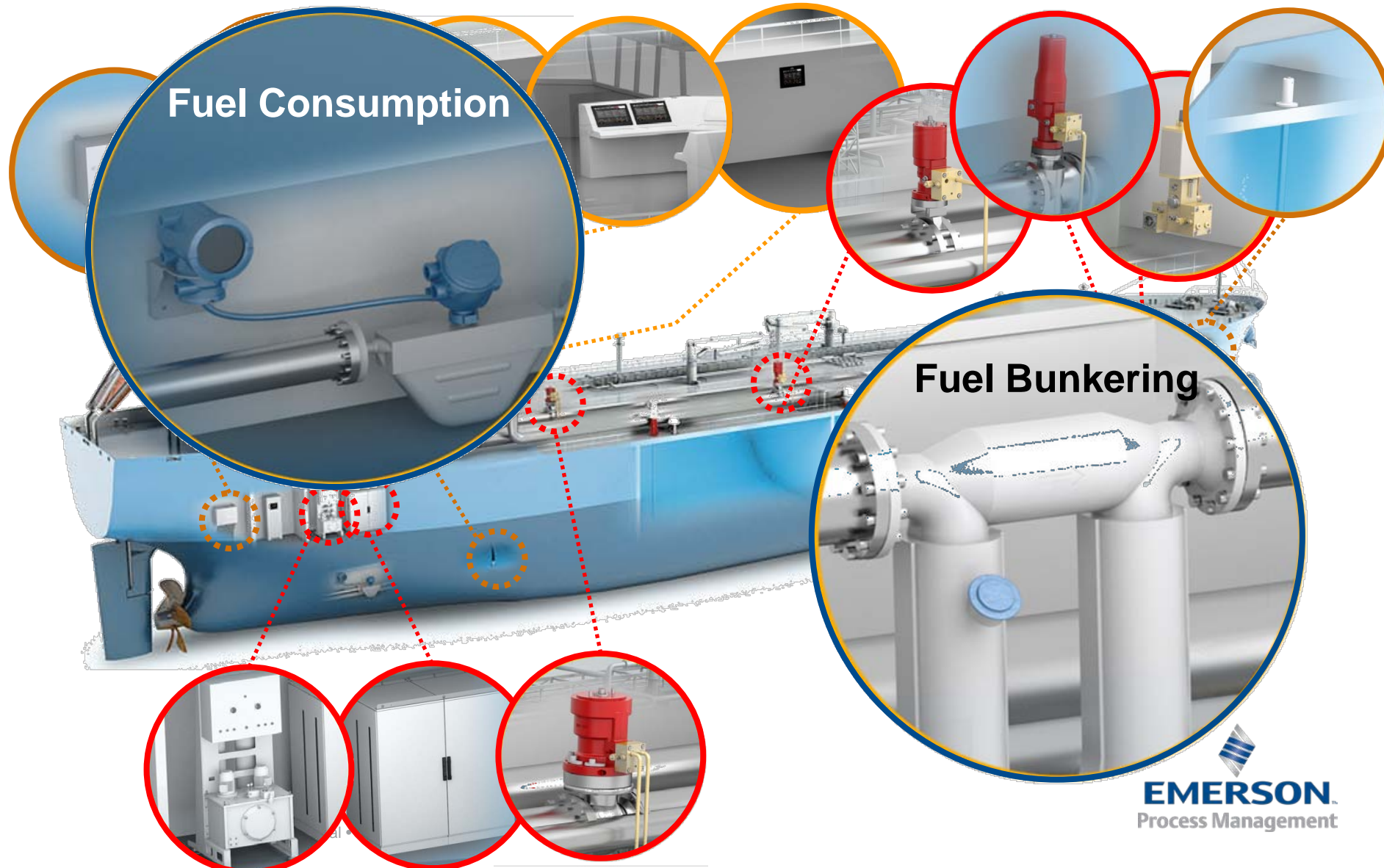
T-Series
Straight Tube full-bore



R-Series
General purpose flow-only

38 years of experience in Coriolis technology

Emerson Knows The Marine and Shipping Industry



Fuel Consumption

Fuel Bunkering

MPA Announcement Establishes Timeline for Mandatory Coriolis Bunker System

Home > News centre >

Port of Singapore is First in the World to Mandate the Adoption of Mass Flow Metering System for Bunkering

Announcement by MPA by Mr Lui on 8th April 2014

- Existing fleet : Mandatory use of mass flow metering (MFM) system for Marine Fuel Oil (MFO) bunkering in Singapore – **1st January 2017**
- New builds : Mandatory from **1st January 2015**



Mr Lui Tuck Yew, Minister for Transport, says the port is the first in the world to mandate the use of flow meters.

MPA Tech Requirements Final draft is due in 2016 Q1

- Status Update
 - Approx 150 HFO barges in Singapore
 - 35 barges certified to-date
 - Some vessels owners frequenting S'pore have opted not to install meters on their vessels
 - Many owners still want the meter as a check meter and for ports which don't have meters
 - Lots of work ahead in FY16

Bunker Tanker Operations - Real Field Data

Results from Jan 2014 to April 2014

- Meter in vs. meter out = 0.01% or 12.9 mt over a total delivery of 136,537.2 mt
- Total is based on the sum of the delivery figures over four months.



Loading (Terminal Meter)
136,606.49 mT



Meter In (Barge Meter)
136,537.24 mT



Meter out (Barge Meter)
136,550.13 mT

Terminal - Meter in
0.05%

Meter out - Meter in
0.01%

Note: Single MPA approved barge data for 96 deliveries
Sounding measurements were used for opening or closing readings of each month

Delivers system performance 50 times better than requirement



Excellent Turn Down for Bunkering Application

Certified Emerson Performance Envelope

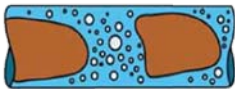
Based on ISO 10265 certification – Defined for Bunkering

Emerson Micro Motion	ELITE CMFHC3	ELITE CMFHC2
Flow rate	120 -1200mt/hr	68 -680mt/hr
Density (kg/m ³ @15C)	940-1050	940-1050
Temperature (C)	30 to 70	30 to 70
Viscosity	120-2400 cSt	120-2400 cSt
Minimum Reynold's Number	100	100

- Covers transferability of water calibration to HFO
- Basis for Singapore's National Metrology Centre NMC Level 2 pass criteria
- Observed average flow rates of barges in Singapore is 300-600mt/hr

Emerson Micro Motion ELITE meters can handle the widest flow rate ranges including low rates and comply with certification

Not all geometries are created Equal

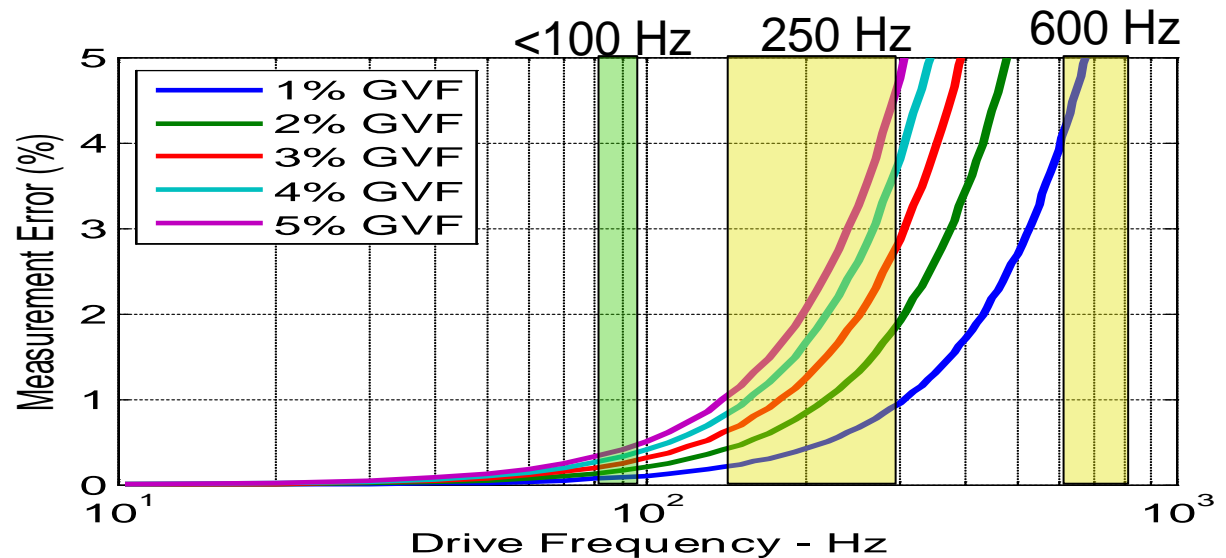


80% Reduced Error with Two-Phase Flow and Entrained Air

- Reduce de-coupling effect with lower frequency system
- Accurately measure fluids with entrained gas
- Fast speed of response ideal for accurate bunkering operations



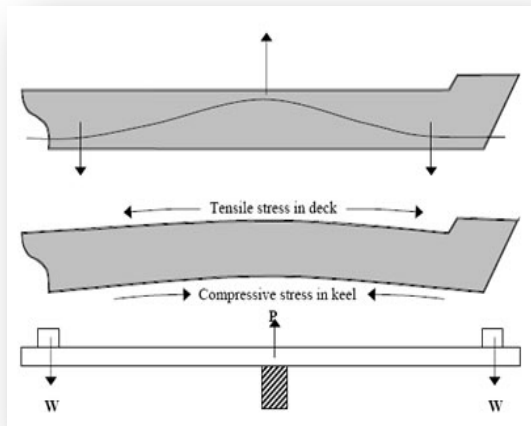
Bunkering operation can have high GVF, therefore it is critical to have a low drive frequency, only available with ELITE tube geometry



Reduced risk to “lose” product and your money

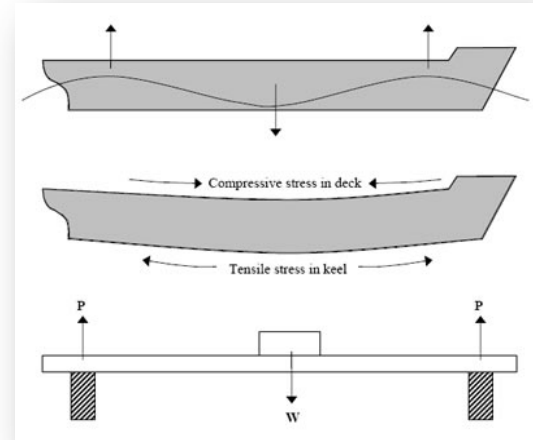
Marine Environment is Different

Hogging



Static Stresses

Sagging



Micro Motion's robust design is built for tough applications



Design with flange-to-flange manifold (tubular steel center section) isolates measurement sensor from environment and pipe effects

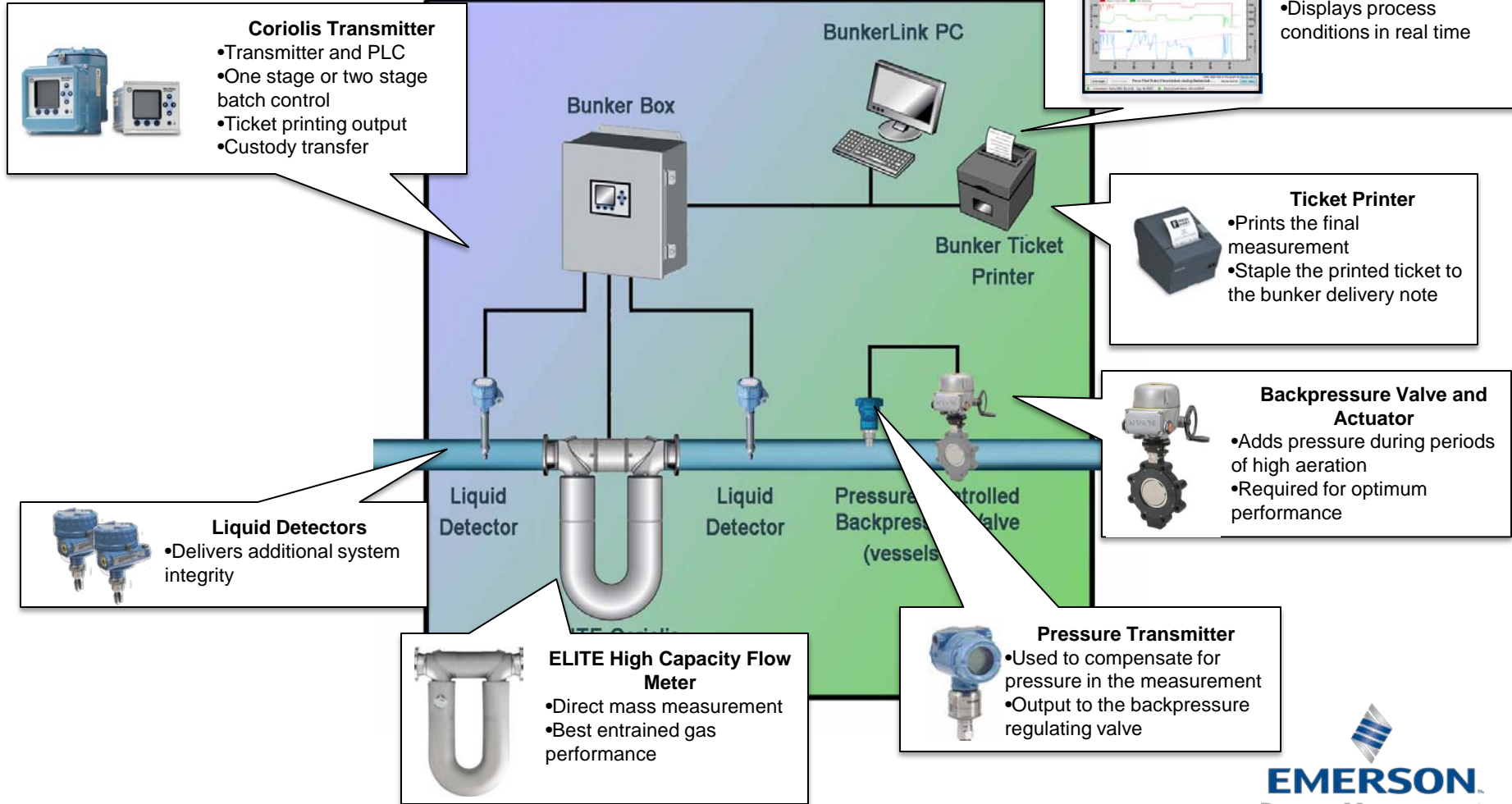
Not susceptible to

- Static stresses from ship or installation
- Environmental changes in temperature
- Process or fluid changes

Long term reliability \$ peace of mind

Not Just a Flowmeter...

Micro Motion Certified Bunker Measurement System



Sample Ticket & Profile Report

MID TICKET FORMAT

Approved Measurement
 Micro Motion Inc, Div of Emerson
 [Header 1]
 [Header 2]
 [Transmitter Tag]

BOL Number: 96

Reset Time
 26-MAR-2011 17:14:49

Print Time
 26-MAR-2011 17:17:46

Valve On Time
 26-MAR-2011 17:15:21

Valve Off Time
 26-MAR-2011 18:17:17


Mass Total
 32.9801 t

Overall OIML R117-1: Pass
 *Accuracy within 0.5%


MID Cert#: xxxx

Approved Measurement
 IMPORTANT: Attach this
 copy to BDN Report
 [Footer]
 Original

SAMPLE PROFILE REPORT



Bunker Delivery Profile
 Emerson's Micro Motion Coriolis Measurement
 This is not a custody transfer document - informational purposes only
 123 Vessel (Header 1)
 123 Barge Company (Header 2)
 ABC Shipping (Tag)



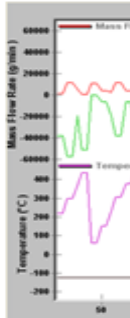
BOL Number: 11	
Reset Time	25-May-2009 14:55:20
Print Time	25-May-2009 19:52:56
Valve on Time	25-May-2009 14:55:20
Valve Off Time	25-May-2009 19:50:20

Mass Total	23.456 ton
Mass Inventory	455.67 ton
Average API Density	975.30 kg/m3
Average Temperature	50.30 C
Aeration Limit	33 %
Minimum Measured Quantity	Pass
No Power Interrupt	Pass
Alarms Occurred	No

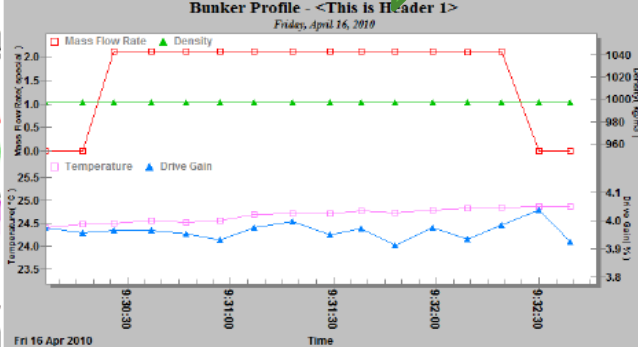
Accuracy within 1%

A View into the Process

Its: Pass



Bunker Profile - <This is Header 1>
 Friday, April 16, 2010



Note: High drive gain combined with low density indicates aeration

MID Certificate #: T10265
 To convert mass to mass in air, multiply by approx. 0.998925
 Footer

Custody Transfer Approvals in Bunkering

FIRST MPA CERTIFIED BARGE IN SINGAPORE



Our Reference: **WMO 423/08**

4 June 2010

Mr Heng Chee Kng
Emerson Process Management Asia Pacific Pte Ltd
1 Pandan Crescent
Singapore 128461

By Fax
Fax no: 6770 8010

Dear Mr Heng

REGISTRATION OF MICRO MOTION CORIOLIS MASS FLOWMETER MEASUREMENT SENSOR MODEL CMFHC2 AND CMFHC3 FOR TRADE USE

We refer to your application form dated 24 May 10 for registration of the above mentioned instrument. We are pleased to inform you that the pattern of coriolis mass flowmeter measurement sensor model CMFHC2 and CMFHC3 are approved and registered with Weights and Measures Office, SPRING Singapore.

Please note that the coriolis mass flowmeter measurement sensor must be verified and stamped by SPRING Singapore/ Authorised Verifier before they can be used for trade.

You are to undertake full responsibility to ensure that the aforesaid Micro Motion model CMFHC2 and CMFHC3 are produced as per Evaluation Certificate No. TC7056 when any of such instruments are submitted for verification and stamping purposes.

Yours sincerely

LIM YONG SENG
Inspector, Weights and Measures Office
SPRING Singapore
Direct: +65 6279 1884
Fax: +65 6458 1441
Email: lim_yong_seng@spring.gov.sg

SPRING Singapore
2 Bukit Merah Central Singapore 159835
Tel: +65 6898 1900 Fax: +65 6278 6667
Website: www.spring.gov.sg

WORLD'S FIRST MASS BUNKER APPROVAL CERTIFICATE



EC type-examination certificate

Number **T10265** Revision 8
Project number 13200231
Page 1 of 1

Issued by NMI Certin B.V., designated and notified by the Netherlands to perform tasks with respect to conformity modules mentioned in article 9 of Directive 2004/22/EC, after having established that the Measuring instrument meets the applicable requirements of Directive 2004/22/EC, to:

Manufacturer Emerson Process Management Flow B.V.
Neonstraat 1
6718 WX Ede
The Netherlands

Measuring instrument A non-interruptible measuring system installed on a ship (barge and vessel), intended for the delivery/reception of fuel.

Manufacturer : Emerson
Type : MMI-MID 003

Q_{max} : See § 1.2 of the description.
Q_{min} : See § 1.2 of the description.
Accuracy class : 0.5
Environment classes : M3 / E3
Temperature range liquid : See § 1.2 of the description.
Temperature range ambient : -25 - +55 °C
Intended for the measurement of : See § 1.2 of the description.

Further properties are described:
- Description T10265 revision 8;
- Documentation folder T10265-7.

Valid until 15 June 2020

Remarks

- The measuring system is approved for measuring mass;
- This revision replaces the previous version, including its documentation folder.

Issuing Authority NMI Certin B.V., Notified Body number 0122
23 July 2013

C. Oosterman

Head Certification Board

This document is issued under the provision that no liability is accepted and that the applicant shall indemnify third party liability.

The designation of NMI Certin B.V. as Notified Body can be verified at notifiedbodies.europa.eu/en/notify/notify.php?mode=details

Parties concerned can lodge objection against this decision, within six weeks after the date of submission to the general manager of NMI (see www.nmi.nl).

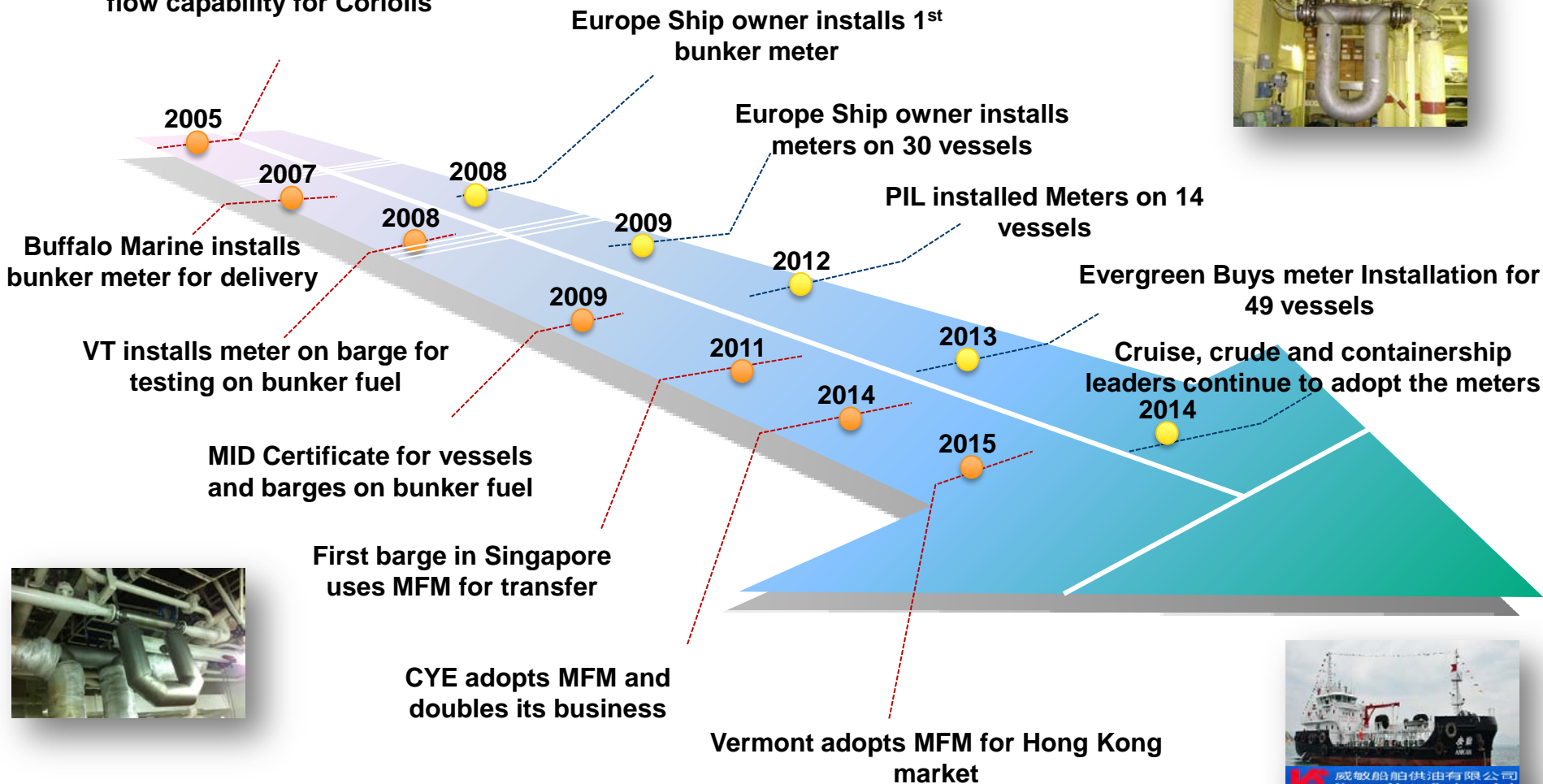
Reproduction of the complete document is permitted.

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certin@nmi.nl
www.nmi.nl



Emerson has Supplied over 300+ Bunkering Systems Globally

Emerson develops 2-phase flow capability for Coriolis



Largest Bunker Meter Install Base Globally

Custody Transfer Approvals in Bunkering

**SUPPLIER DOUBLES SALES
AFTER INTALLING MFMs**



bunkerworld

25th May 2015

**MFM-EQUIPPED BUNKER TANKER
STARTS OPS AT HONG KONG**



bunkerworld

2nd April 2015

One Solution: Reduce Consumption!

Ship Design // Technology Lightweight Construction

A reduction in the ship's weight can lead to a reduction in the propulsive energy required, and hence can lead to fuel savings.

UP TO
4%
FUEL SAVINGS

Ship Design // Technology Liquefied Natural Gas (LNG)

LNG has received substantial attention and class society DNV has predicted that it will be used as the marine fuel of the future once ubiquitous lower sulphur regulations take hold (2020 or 2025).

UP TO
20%
FUEL SAVINGS

Ship Design // Operations Optimisation of Ballast and Trim

Ballast, cargo and bunker distribution and the relationship between these are fundamental to giving the modern ship its optimal position in terms of fuel efficiency.

UP TO
4%
FUEL SAVINGS

Ship Design // Technology Aerodynamics of Superstructure

The aerodynamic resistance of the hull (above water) and superstructure account for approximately 5–8% of the total drag on a ship. For this reason, a number of design consultancies offer modelling of air resistance as a means of optimising the ship's design but none specify possible fuel savings.

UP TO
4%
FUEL SAVINGS

How do you know which investments to make first?

Machinery // Technology Solar Power

Solar cells on deck can reduce fuel consumption for providing on-board power. At least one company also utilises solar power installed on fixed wing sails for propulsion (currently on small ferries but with plans to apply the technology to larger vessels).

UP TO
45%
FUEL SAVINGS

Ship Design // Technology Optimisation of Propeller/Hull Interface

UP TO
2%
FUEL SAVINGS

UP TO
5%
FUEL SAVINGS

Strategies // Technological Hull Surface Coating

Hull coating technology is moving fast, and the latest coatings have shown potential for considerable eco-efficiency savings over a few years. A coating upgrade offers a quick and simple improvement both newbuilds and retrofits.

UP TO
10%
FUEL SAVINGS

Ship Design // Technology Air Lubrication

Air lubrication can be quite significantly more efficient than a layer of air pumped between the hull and water. There are two main variants of this idea.

UP TO
15%
FUEL SAVINGS

Strategies // Technological

H

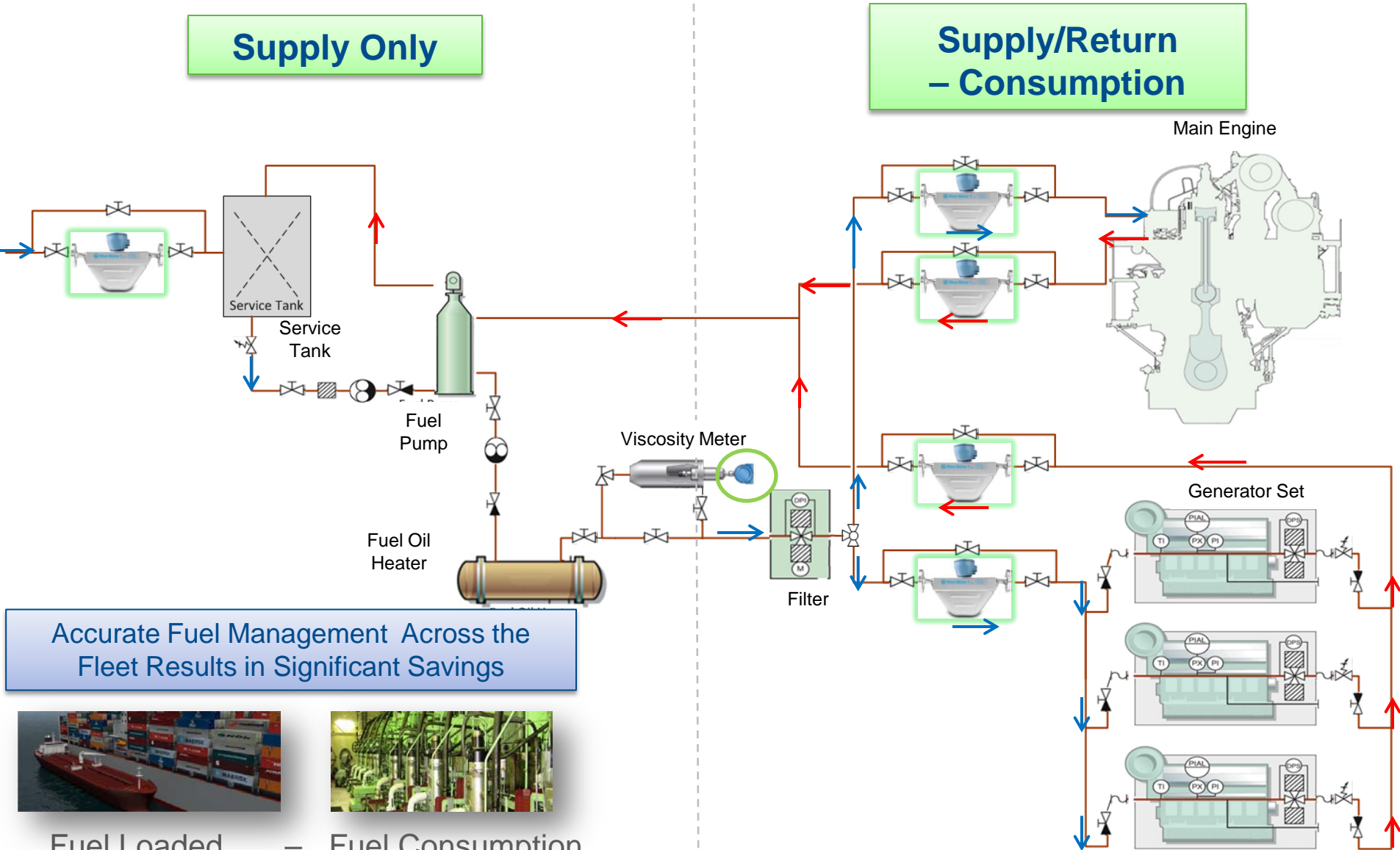
Software packages are available that monitor hull (and often propeller) condition and recommends optimum time for scrubbing. They achieve this by monitoring the shaft power required at a reference speed and alerting the operator when this increases beyond a certain threshold.

Establish an energy baseline

Fuel Consumption Application Types

Supply Only

Supply/Return
– Consumption



Accurate Fuel Management Across the Fleet Results in Significant Savings

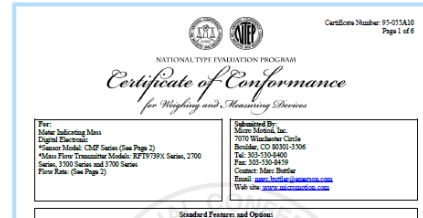
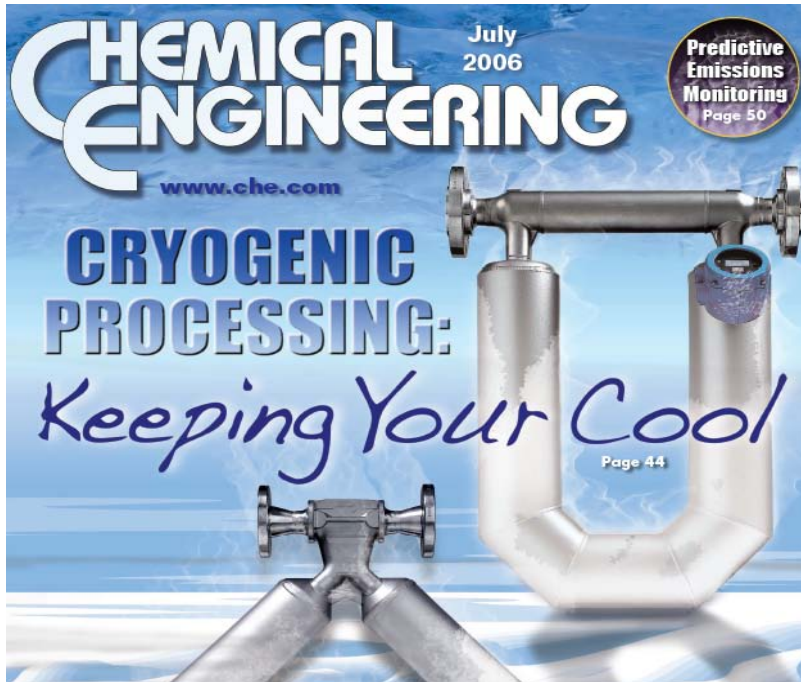


Fuel Loaded – Fuel Consumption

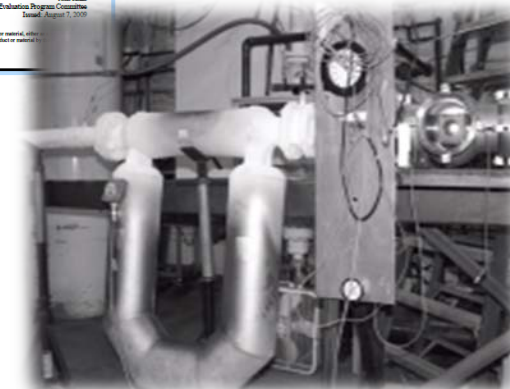
Micro Motion Mass Flow Meter for LNG

LNG is just a cold liquid, nothing special for Micro Motion Mass Flow Meter

- Micro Motion is the 1st manufacturer with an MID system certificate
- 17 years of cryogenic & LNG experiences



Cryogenic Custody Transfer Approval – NMI, NTEP





Takeaways

- Know exactly how much was transferred before you leave
- Bunker faster and more accurately
- Maintain complete fuel inventory management of your vessel/ fleet
- LNG metering is not difficult



THE MECHANICS AND JUSTIFICATION FOR BUNKER METERING

Thank you



EMERSON
Process Management