

FREQUENTLY ASKED QUESTIONS ON MASS FLOW METERING (MFM) FOR BUNKERING

Q1: Are MFM a recent technology? Has it been tried and tested?

A: The MFM is not a recent technology. The First Industrial Patent for the MFM dates back to the 1950s and the first meter was manufactured in 1970s. Today it's widely used in industries such as the Oil & Gas, Chemical, Life Sciences, F&B etc. American Petroleum Institute (API) has approved the use of MFM for custody transfer in 2002. (API MPMS 5.6 Coriolis flowmeters)

Q2: How does MFM measures mass directly?

A: The MFM operates on the Coriolis principle which measures the oscillation frequency (ie: twisting) of the measuring tubes in the meter. The sensors, at the inlet and outlet ends, register the resultant phase shift in the tube's oscillation geometry and compute the rate of mass flow.

Q3: Why has it taken so long for bunker quantity measurements to adopt metering while automobile fuels retailers has adopted metering for some time?

A: The use of MFM for bunkering is not a "plug & play" system. From our experience in the test bedding programme, we learnt that the piping configuration on each bunker tanker might vary. A proper set-up, including the piping configurations, is crucial to ensure the optimal performance of the entire MFM system.

In 2009, MPA and SPRING Singapore jointly initiated a MFM Working Group (WG) to develop and validate the use of MFM for bunkering. Since 2011, MPA and the WG had conducted extensive trials to ensure that the system is suitable for Singapore's bunkering environment. With the success of the trials, MPA had, in June 2012, approved the first MFM for official custody transfer in the Port of Singapore. The first MFM was an Emerson's meter. In Oct 2013, MPA approved an MFM produced by Endress & Hauser for use in the port of Singapore.

It is important to note that the approval for custody transfer is not a system-type approval. All individual MFM systems need to undergo and pass the physical acceptance test before approval is granted by MPA.

Q4: When will the delivery procedures by MFM be incorporated into SS600?

A: The WG is currently developing a Technical Reference (TR) which will eventually be developed into a Singapore Standards (SS).

In the interim, the Singapore Standard Code of Practice for Bunkering (SS600) is being revised and will incorporate the use of MFM for bunker deliveries. The revised SS600 (SS600:2014) will be launched at SIBCON 2014. All MFM deliveries will have to adhere to the MPA- approved bunker tanker specific procedures. MPA has also published a Generic Mass Flow Metering (MFM) delivery procedure for the industry as a guide for the bunkering stakeholders

Q5: What are the 3rd party certifications or audits that MFM installations are subjected to?

A: MFMs are calibrated in accordance to SPRING Singapore's requirement. The requirements are in line with both OIML R117 and ISO 17025 standards. All MFM systems onboard bunker tankers are to be evaluated and approved by MPA, before they are allowed to be used for custody transfer of bunkers.

Q6: How reliable is the MFM system and are there any contingency plans when the system breaks down?

A: There are minimal moving parts in the system and MFMs have been reliably employed in other applications. MFM systems are also equipped with an uninterrupted power source (UPS) that is able to run the system in the event of a power failure.

In the unlikely event that the MFM stopped in the middle of a bunkering operation, pumping shall be stopped immediately and the meter's totalizer readings shall be recorded. Tank gauging, in accordance with SS 600, shall be used to determine the remaining quantity to be delivered and a separate BDN shall be issued. The final quantity delivered shall be the sum determined from the meter readings and the tank gauging recorded in the respective BDNs.

This procedure is covered under the Generic Generic Mass Flow Metering (MFM) delivery procedure that is available at http://www.mpa.gov.sg/sites/pdf/generic_mfm_delivery_procedure.pdf

Q7: Incentive eligibility

A: MPA has an incentive scheme to assist the industry in defraying a portion of the cost of MFM adoption. MPA will be making a lump sum payment of \$80,000 for all **existing bunker tankers** (holding a valid SB Harbour Craft (bunker tanker) licence) delivering MFO in the port, upon the final approval for MFM to be used for custody transfer for each bunker tanker.

Q8: I have a new bunker tanker which is estimated to be delivered between now and 31 Dec 2014. Do I qualify for the incentive?

A: New bunker tankers will not be eligible for the incentive. For new bunker tankers that are being registered between now till 31 Dec 2014, it is advisable to install the MFM system as soon as possible. The bunker tanker will be scheduled for the acceptance test to be conducted by MPA. The bunker tanker will not be allowed to deliver MFO after 1 Jan 2017.

Q9: What is the approval process for MFM system and what is the downtime expected?

A: The approval for MFM is an 8-step process (Annex A) covering from system procurement until the final approval for custody transfer. The entire process is estimated to take around 4 months. However, the downtime for the bunker tanker is approximately 1.5 weeks.

(Installation: 1 week, acceptance test: 3 days)

MPA will be scheduling existing bunker tankers for the acceptance test. This will be done approximately 2 weeks after the deadline of the docking of the bunker tankers. With this arrangement, the downtime of the bunker tankers will be minimised.

Q10: What happens when there is a difference between the reading of MFM and the terminal delivered figure during loading?

A: All custody transfer meters used in terminals are required to follow the requirements as stipulated by SPRING Singapore. SPRING Singapore's requirement for the MFM is similar.

Our trial results showed that the variance between the MFM reading and the terminal delivered figure are within the industry acceptable standard of 0.5%. In addition, there is no change from the current arrangement and procedures when bunker tankers load from terminals. In the event of a bunker quantity dispute, the bunker tanker should raise a note of protest as per current practice. In such situation, the bunker tanker will be able to understand the loading operation in greater details through the recorded data.

Q11: How often will calibration be done and how is it done?

A: SPRING Singapore requires calibration procedures to comply with international standards OIML R117 and ISO 17025. The current requirement is for the meter to be calibrated every 3 years. Unlike traditional geared meters, MFM does not have mechanical parts or moving parts and therefore the need for re-calibration is relatively lower. The current approved meters were evaluated and are still performing in good condition.

Under the current practice, the MFM is required to be sent to a SPRING Singapore's Recognised Testing Laboratory (RTL) for re-verification/re-calibration. The bunker craft operator should time such operation to coincide with its docking schedule to reduce the downtime for the bunker tanker.

Q12: Will my bunker tanker still be allowed to perform delivery via sounding (SS600) once the MFM system is approved for use by the bunker tanker??

A: The mandatory use of MFM for MFO delivery is 1 Jan 2017. Once MPA approves the MFM system for custody transfer for the bunker tanker, the approved MFM system should be used as the default measuring equipment for bunker transfer/deliveries. In the event, there is a contractual agreement, between buyers and sellers, to use SS600 procedures (sounding) to measure the quantity of bunkers, MPA will not object to the arrangement. However, the MFM system shall be kept operational during all operations and the information recorded on the MFM system will be used in bunker dispute investigations.

Q13: How will the cost of bunker be affected by the implementation of MFM?

A: MPA calculated the monetary impact to bunker supplier and bunker craft operator using the cost of the MFM system as a base. The calculations did not consider the gain in efficiency enjoyed by the bunker craft operator with the expected bunker tanker’s higher turnaround rate.

Items	Cost
Estimated cost of MFM inclusive of installation	\$220,000 (Estimated cost of \$300,000 - \$80,000*)
Estimated yearly maintenance cost inclusive of calibrations	\$20,000
Period of amortization	5 years
Average tanker capacity	4000
Average number of turns per month	8
Bunker delivered per month	32,000 mt
Unit cost for MFM	\$0.17/mt

*MPA incentive of \$80,000 to existing bunker tankers delivering MFO

Q14: How is the testing of MFM system conducted?

A: Since 2011, MPA and the Working Group had conducted extensive trials on the MFM at varying operating conditions to ensure that the system is suitable for Singapore’s bunkering environment. A total of 17 bunker tankers participated in the test-bedding programme.

All meters approved for custody transfer meets the recommendations set by the Organisation of Legal Metrology (OIML)’s R117:2007 standard - an international recommendation for measuring system for liquids other than water.

The meters are then sent to a SPRING Singapore’s Recognised Testing Laboratory (RTL) for calibration before it is installed on the bunker tanker. Once fitted onboard and sealed, all MFM systems have to undergo 3 rounds of test. During the tests, the entire delivery system are put through the verification process to ensure all pass-by are blanked out and sealed. Sealings are to be done by an independent party to ensure the integrity of the system. The data collected during the test were sent to Singapore’s National Metrology Centre for validation.

Q15: How do I ensure the integrity of MFM system is not compromised?

A: MPA requires the meter system set up to have no by-pass of flow after the meter. Any pass-by system on bunker tankers shall be blanked out and sealed.

Under the approved delivery procedure, opening and closing procedures for a bunker delivery differ slightly All bunker tankers installed with the MPA-approved MFM are to maintain the latest seal verification report and metering system diagram indicating all the sealing points. The vessel representative and bunker surveyor, if engaged, are required to check and ensure all listed seals are intact. They shall sign on the Mass Flow Metering System Seal Checklist to indicate that the seals are intact. The same should be done be done for the closing procedure.

Other than the Mass Flow Metering System Seal Checklist, the Meter Reading Record Form and Bunker Metering Ticket generated by the system will provide an additional layer of security. All these requirements are stated in the Generic Mass Flow Metering (MFM) delivery procedure.

Q16: How will transparency be enhanced when compared to tank sounding?

A: There is continuous digital data captured during the delivery process, the data can be viewed in the form of a delivery profile. At any instance in time, and we are able to trace the amount of mass transferred. The MFM system is also able to detect changes in operating conditions e.g. when we change supply tank, or when we clear the lines at the end of the delivery.

The delivery profile data can be extracted from the system, if required.

Q17: Is there still a need for bunker surveyors for deliveries done via the mass-flow meters?

A: Yes. The role of bunker surveyor being an independent party to witness and ensure compliance to bunker delivery processes remains unchanged.

There is a change in the function of bunker surveyors for MFM deliveries. For example, the surveyor is required to cross check the seal verification report and the actual physical seals at various locations in the MFM system. This procedure is to ensure the integrity of the entire MFM before and after the delivery. The detailed actions required from bunker surveyors are covered under the Generic MFM delivery procedure.

MPA is also looking to expand the scope of work for surveyor and exploring the possibilities to train bunker surveyor to perform zero verification for approved MFM system.

Q18: Will there be training provided to ensure bunker surveyors have the competency on MFM delivery?

A: Yes. MPA is currently working with various organisations to conduct technical workshops, pre-conference symposium and bunker surveyor refresher courses to ensure bunker surveyors attain the competency to handle MFM delivery. We will be contacting accredited bunker surveying firms to share further details.

Q19: If it's required by the owner/charterer to perform opening/closing using sounding method. Will MPA allow it?

A: For a bunker delivery done via a MPA- approved MFM system, there is no need for sounding to be conducted. The BDN will reflect the delivered amount as registered on the MFM system. In the event there is a contractual agreement between the bunker buyer and bunker supplier to conduct a bunker delivery as per SS600 procedures, MPA will not object to such arrangement before 1 Jan 2017. However the appointed cargo officer and bunker surveyor shall ensure that the MFM system is kept operational during all operations.

Documents available on MPA website

Generic Mass Flow Metering (MFM) delivery procedure

http://www.mpa.gov.sg/sites/pdf/generic_mfm_delivery_procedure.pdf

Annex A

Step	Certification stages	Details	Endorsing Party
1	Procurement of MFM system	1. Sizing of MFM (correct operating range) 2. Registration with MPA for incentive scheme, if eligible (Submission of Purchase order)	MPA
2	Arrival of MFM system	1. Complete water calibration 2. Submission of all required documents to SPRING Singapore	
3	SPRING Singapore's approval	1. Level 1 & 2 approval	SPRING Singapore
4	Installation of MFM system	1. Installation 2. Development of sealing plan	
5	MFM System Commissioning	1. Submission of class endorsed revised piping diagram and proposed seals location for endorsement by MPA 2. Submission of bunker tanker specific MFM delivery procedure (to refer to generic MFM delivery procedure) 3. Submission of MFM vendor and BCO's attestation on system & crew readiness for acceptance test 4. Completion of sealing by SPRING Singapore & Authorised Verifier/ authorised organisation(s)	MPA
6	Official Acceptance test of MFM system	1. 3 runs of test (3 x loadings and 3 x deliveries with MPA chartered bunker tanker. Test date is scheduled by MPA (approximately 2 weeks after deadline of docking)	Data collection supervisor, test leader
7	Data Verification of test result by National Metrology Centre	1. Submission of test data and test documents	NMC, A*STAR
8	Submission of documents to MPA for approval	1. Submission of all relevant documents* 2. Lump sum incentive payment, if applicable	MPA

*list of documents required for application

1. Meter Certification
2. Water Calibration Certification
3. SPRING Singapore certification of verification
4. Water to Bunker conversion attestation
5. Mass Flow Metering system (Design, layout, configuration etc)
6. Endorsed Sealing plan and bunker tanker piping diagram
7. Latest Seal verification report
8. Zero verification procedure
9. All Zero verification reports
10. Endorsed MFM delivery procedure specific to the bunker tanker