

~~TR 48 : 2015~~

SS 648 : 2019

(ICS 01.140.30; 47.020)

~~TECHNICAL REFERENCE~~

~~Bunker mass flow metering~~

SINGAPORE STANDARD

Code of practice for bunker mass flow metering

~~TR 48 : 2015 SS~~

648 : 2019

(ICS 01.140.30; 47.020)

~~TECHNICAL REFERENCE~~ SINGAPORE STANDARD
Code of practice for bunker mass flow metering

Published by Enterprise Singapore

All rights reserved. Unless otherwise specified, no part of this Singapore Standard may be reproduced or utilised in any form or by any means, electronic or mechanical, including photocopying and microfilming, without permission in writing from Enterprise Singapore. Request for permission can be sent to: standards@enterprisesg.gov.sg.

~~ISBN 978-981-4726-22-1~~

© Enterprise Singapore 2019

ISBN 978-981-48-9451-7

The content of this Singapore Standard was approved on 23 September 2019 by the Chemical Standards Committee (CSC) under the purview of the Singapore Standards Council.

First published, ~~2016~~ 2019

NOTE

- ~~1. Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions.~~
- ~~2. An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR.~~
- ~~3. Compliance with a SS or TR does not exempt users from any legal obligations.~~

CSC consists of the following members:

	Name	Representation
Chairman	: Dr Keith Carpenter	<i>Individual Capacity</i>
Deputy Chairman	: Er. Lucas Ng	<i>Individual Capacity</i>
Secretaries	: Ms Elane Ng	<i>Standards Development Organisation @ Singapore Chemical Industry Council</i>
	Ms Rosmalinda Tay	<i>Standards Development Organisation @ Singapore Chemical Industry Council</i>
Members	: Mr Goh Tiak Boon	<i>Individual Capacity</i>
	Prof Alfred Huan	<i>Individual Capacity</i>
	Mr Khong Beng Wee	<i>Individual Capacity</i>
	Mr Terence Koh	<i>Singapore Chemical Industry Council Limited</i>
	Dr Leong Kwai Yin	<i>Individual Capacity</i>
	Dr Thomas Liew	<i>National Metrology Centre</i>
	Mr Lim Eng Kiat	<i>Individual Capacity</i>
	Mdm Jaime Lim	<i>Ministry of Manpower</i>
	Mr Lim Kian Chye / Mr Ng Eng Fu	<i>Housing & Development Board</i>
	Prof Loh Kian Ping	<i>National University of Singapore</i>
	Dr Loh Wah Sing	<i>Individual Capacity</i>
	Ms Pamela Phua	<i>Singapore Paint Industry Association</i>
	Mr Seah Khen Hee	<i>Individual Capacity</i>
	A/Prof Timothy Tan	<i>Nanyang Technological University</i>
	Dr Teo Tang Lin	<i>Chemical Metrology Division, Health Sciences Authority</i>
	Mr Yao Yikai	<i>Maritime and Port Authority of Singapore</i>
	Ms Suzanna Yap	<i>National Environment Agency</i>
Co-opted Members	: Ms Christina Loh	<i>Individual Capacity</i>
	Mr Pitt Kwan Wah	<i>Individual Capacity</i>

CSC sets up the Technical Committee on Bunkering to oversee the preparation of this standard. The Technical Committee consists of the following members:

	Name	Representation
Chairman	: Mr Seah Khen Hee	<i>Individual Capacity</i>
Deputy Chairman	: Mr Lee Wai Pong	<i>Individual Capacity</i>
Secretary	: Ms Elane Ng	<i>Standards Development Organisation @Singapore Chemical Industry Council</i>
Members	: Ms Maite Bolivar Klarup	<i>Baltic and International Maritime Council</i>
	Mr Dennis Chan	<i>Singapore Chamber of Maritime Arbitration</i>
	Mr Chew Siu Keong / Mr Loh Yuanhe	<i>Maritime and Port Authority of Singapore</i>
	Capt. Rahul Choudhuri	<i>Veritas Petroleum Services (Asia) Pte Ltd</i>
	Mr Timothy Cosulich	<i>International Bunker Industry Association (Asia) Ltd</i>
	Mr Darajit Daud	<i>SGS Testing & Control Services Singapore Pte Ltd</i>
	Mr Md Elfian Harun	<i>The International Association of Independent Tanker Owners</i>
	Mr Kenneth Kee	<i>Society of Naval Architects and Marine Engineers Singapore</i>
	Ms Samantha Leow	<i>ExxonMobil Asia Pacific Pte Ltd</i>
	Capt. Say Eng Sin	<i>Singapore Nautical Institute</i>
	Mr Roger Tan	<i>Shell Eastern Trading Pte Ltd</i>
	Mr Thiang Cheong Sheng	<i>Singapore Shipping Association</i>
	Mr Wu Jian	<i>National Metrology Centre</i>
	Ms Caroline Yang	<i>Singapore Shipping Association</i>
Co-opted Members	: Mr Desmond Chong	<i>Individual Capacity</i>
	Mr Simon Neo	<i>Individual Capacity</i>
	Mr Darrick Pang	<i>Individual Capacity</i>
	Capt. Yoon Peng Kwan	<i>Individual Capacity</i>

The Technical Committee sets up Working Group on Mass Flow Metering to prepare this standard. The Working Group consists of the following experts who contribute in their *individual capacity*:

	Name
Co-Convenors	: Capt. Yoon Peng Kwan Mr Alan Lim*
Members	: Mr Mohamed Abdenbi Mr Peter Beekhuis Mr Mathews George Mr Naveen Hegde Mr Dennis Ho Mr Jens Maul Jorgensen Mr Sherman Lee Ms Samantha Leow

Members : Mr Lim Yong Seng
Mr Jony Ling*
Mr Loh Yuanhe
Mr Bhavin Mehta
Capt. Hoque Mominul
Mr Simon Neo
Mr Darrick Pang
Mr Dennis Sim
Mr Roger Tan
Mr Thiang Cheong Sheng
Mr Wu Jian
Mr Andrew Yap*
Ms Celeste Yeong

**Served till May 2019.*

The organisations in which the experts of the Working Group are involved are:

*Emerson Process Management Marine Solutions Singapore Pte Ltd
Endress+Hauser (S.E.A.) Pte Ltd
Enterprise Singapore
ExxonMobil Asia Pacific Pte Ltd
Krohne (South East Asia) Pte Ltd
Maersk Oil Trading Singapore Pte Ltd
Maritec Pte Ltd
Maritime and Port Authority of Singapore
Metcore International Pte Ltd
National Metrology Centre
Ocean Tankers Pte Ltd
Oldendorff Carriers GmbH & Co.
Pacific International Lines Pte Ltd
Peninsula Petroleum Limited
Piroj International Pte Ltd
Sentek Marine & Trading Pte Ltd
SGS Testing & Control Services Singapore Pte Ltd
Shell International Eastern Trading Company
Sinanju Tankers Pte Ltd
Veritas Petroleum Services (Asia) Pte Ltd*

Contents

	Page
Foreword	5 7
0 Introduction	6 9
1 Scope	6 9
2 Normative references	7 10
3 Terms and definitions	7 10
4 Abbreviations	13 17
5 General requirements (safety, health and the environment)	14 17
6 Traceability and calibration Metrological requirements	14 17
7 System integrity requirements	16 20
8 Meter selection and installation requirements	19 23
9 Acceptance test requirements	21 25
10 Metering procedures	21 25

Annexes

A Safety, health and the environment (normative)	33 38
B Zero verification procedures (normative)	42
B C Summary table on Metrological and system integrity requirements (normative)	37 43
D Example of ancillary device sealing (informative)	44
E Sealable bolts and nuts for blanks and flanges (normative)	45
C F Request for information checklist (informative)	38 46
D G Typical schematic diagram of MFM system (for delivery) (informative)	40 48
E H Markings on stamping plate of mass flow meter (informative)	41 49
F Sealable bolts and nuts for blanks and flanges (normative)	42
C I Acceptance test requirements (normative)	43 50
H J 8-step approval process (normative)	47 54
I K Example of a test plan (informative)	48 55
J L Competency and responsibility of test team members (normative)	51 58
K M Schematic description of an example of acceptance test (informative)	52 59
L N MFM system acceptance test records (normative)	56 62
M O Example of bunker requisition form (mass flow metering) (informative)	63 70
N P Example of mass flow metering system seals checklist (informative)	64 71
O Q Example of meter reading record form (delivery) (informative)	65 72
P R Bunker delivery note (BDN) (normative)	66 73
Q S Example of bunker metering ticket (informative)	67 74
R T Example of a survey time log (informative)	68 75

	Page
S U Example of a statement of fact (informative)	69 76
T Example of a pre-survey vessel acknowledgement (informative)	70
U Example of a vessel measurement report (informative)	71
V Example of a gauging ticket (informative)	72
W V Bunkering pre-delivery safety checklist (informative)	73 77
X W Sampling (normative)	75 79
Y X Example of a sample label (informative)	81 84
Y Responsibilities of bunker surveyor (normative)	85
Z Example of meter totaliser log (informative)	82 86
AA Examples of note of protest (informative)	83 87
AB Mass flow metering bunker claims (MFMBBC) procedure (informative)	85 89
AC Resolution of disputes (informative)	87 91
AD Singapore bunker claims procedure (SBC terms) (informative)	88 92
AE Schematic diagrams of multi meter set up (informative)	97

Tables

1 Uncertainty budget table	15 19
2 Size of reducers and adaptors	30 34
G I.1 Representative samples	45 52

Figures

1 Application of MFM bunkering requirements	9
A.1 Examples of hand signals for bunkering communication	34 39
D.1 Example of sealed pressure transmitter (instrument)	44
F E.1 Sealable bolt and nut	42 45
F E.2 Example of sealed pipe blank	42 45
X W.1 Design of sampling equipment— Example 1	78 81
X.2 Design of sampling equipment— Example 2	79
X.3 W.2 Example of design of sample bottle neck and cap	80 82
AE.1 Example of a two MFMs installed in parallel (for same grade of bunker fuel)	97
AE.2 Example of a two MFMs installed separately (for different grade of bunker fuel)	98
Bibliography	99

Foreword

This ~~Technical Reference (TR)~~ Singapore Standard was prepared by the Working Group ~~(WG)~~ on Mass Flow Metering ~~appointed~~ set up by the Technical Committee ~~for~~ on Bunkering under the purview of the Chemical Standards Committee ~~(CSC)~~.

This ~~TR is based on the current knowledge, extensive field trials and experience gained in the new application of Coriolis~~ standard was first developed as TR 48 : 2015, "Technical Reference for bunker mass flow metering ~~technology for the bunkering industry~~". TR 48 was

~~This TR is a provisional standard made available for application over a period of two years. The aim is to use the experience gained to update the TR so that it can be adopted as a Singapore Standard. Users of the TR are invited to provide feedback on its technical content, clarity and ease of use. Feedback can be submitted using the form provided in the TR. At the end of the two years, the TR will be reviewed, taking into account any feedback or other considerations, to further its development into a Singapore Standard if found suitable.~~

The changes resulting from the review are as follows:

- Expanded the scope of the standard to cover 2020 compliant fuels such as distillate fuels;
- Included multi meter installation;
- Enhanced zero verification procedure;
- Provided better clarity on the role of bunker surveyors.

In preparing this ~~TR~~ standard, reference was made to the following ~~standards~~ publications:

American Petroleum Institute Manual of Petroleum Measurement Standards

API MPMS 5.6:2002(2008) Measurement of liquid hydrocarbons by Coriolis meters

American Society of Mechanical Engineers

ASME MFC-11:2006 (R2014) Measurement of fluid flow by means of Coriolis mass flow meters

International Organization for Standardization

ISO 10790:~~1999~~2015 Measurement of fluid flow in closed conduits – Guidance to the selection, installation and use of Coriolis ~~meters~~ flowmeters (mass flow, density and volume flow measurements)

ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories

Bureau International des Poids et Mesures

Joint Committee for Guides in Metrology JCGM 200:2012 International vocabulary of metrology – Basic and general concepts and associated terms (VIM) 3rd Edition

International Organization of Legal Metrology

OIML D028:2004 Conventional value of the result of weighing in air

Reproduction of content from OIML D028: 2004 complies with OIML B11 - "Rules governing the translation, copyright and distribution of OIML Publications"

Some of the definitions in Clause 3 were reproduced from the above publications with permission from the respective organisations as indicated in brackets after the definitions. All rights are reserved by the organisations.

Acknowledgement is made for the use of information from the above publications.