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Gerd Würsig

The Safety Principles for the Use of Low Flashpoint Fuels in Shipping

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The author's hope is that this publication may support the daily work of all those who are designing, building and operating gas carriers and ships which use fuel alternatives to the well known fuel oil.

Preface

The "International Code of Safety for Ships using Gases or other Low-Flashpoint Fuels"[1] [1] is the International Maritime Organization's (IMO) instrument to regulate the safety of handling fuels which were not commonly used in shipping prior to the introduction of this Code in 2015. The more precise date of the milestone for the so called "IGF-Code" is the afternoon on Friday 12th of June 2015 when the IMO MSC-95 meeting ended and the Adoption of the IGF-Code became a reality. It may be a coincidence but for the author, the fact that Meyer Werft and Carnival Corporation launched a press release about the building of four LNG fuelled Cruise ships after the weekend on Monday 15th of June 2015, highlights the relevance of the IGF-Code to shipping (comp. Annex, p.125).

At the beginning of the development in 2004 the Norwegian Administration proposed a Guideline for Gas as fuel assuming that Methane stored as LNG would be the only gas used as fuel for ships like on the first Norwegian ferry operated with LNG as fuel the "MS GLUTRA" (Fig. 1).[2]

Fig. 1 First Norwegian non-LNG Carrier fuelled with LNG as fuel: MS GLUTRA September 2003. (*Source* Dr. Gerd Wuersig)

[1] *Flashpoint* comp. Glossary, p. 129.

[2] The Norwegian proposal to the IMO was based on the experience with the "MS Glutra".

Consequently, the IMO working group installed to develop an International Code named it "International Gas as Fuel-Code" or "IGF-Code". This acronym became very famous. No one liked to change it even though it became clear that other unconventional fuels for shipping need new regulations. For this very human, practical reason the acronym "IGF-Code" was saved by renaming it the "**I**nternational **C**ode of Safety for Ships using **G**ases or other Low-Flashpoint **F**uels". It is a little bit inconsistent that the word "Code" is the second word of the title but is at the end of the acronym.[3]

The anecdote about the naming of the IGF-Code illustrates a motivation for writing this publication. Technical regulations like the IGF-Code [1] are developed by large groups of experts over long periods of time. The explanation of the background for the requirements of such rules is not part of the development process. Consequently, very often the reasoning behind the rules is lost over time or at least hidden from the end user.

This publication aims to explain the safety principles behind the rules for ships which use unconventional fuels.[4] The hope of the author is that the understanding of the safety principles may contribute to the technological based interpretation of the rules and their further development.

The reader should note that this publication is written to explain the subject and not as a scientific textbook. Some parts may be seen by some "professionals" to be "too simple", "incomplete", "not meeting the scientific standards" but this is because the aim is not to write a scientific work. Even if the subject may be seen as a "very dry" one, the author wanted to have some fun writing it down. This may be one explanation.[5]

Those who might be interested in the development of the basic IGF-Code may read the keynote from Motorship Conference—Gas fuelled ships—in Hamburg from 10th to 12th November 2015 [2].

The author assumes no responsibility or liability for any errors or omissions in the content of the book. Neither can he guarantee completeness, accuracy, usefulness or timeliness. In particular, the author is not responsible for any errors or omissions, or for the results obtained from the use of this information.

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[3] Note that IMO CCC-8 in 2022 decided to change the wording from "Low-Flashpoint Fuels" to "Alternative Fuels". Time will show what will happen to the title of the IGF-Code.

[4] In this context "conventional fuels" are the oil based fuels used prior to LNG and the other "low flashpoint"/"alternative fuels".

[5] Life is too seriously to take it serious (Google "thinks" that Oscar Wilde may have written this).

[6] My name is written "Würsig" in German. But this looks to me to be too unconventional for most readers.

References

1. IMO (2016), IMO Resolution MSC.391(95), IGF-Code: International Code of Safety for Ships using Gases or other Low-Flashpoint Fuels, IMO, London, ISBN 978-92-801-1653-3
2. Wuersig, Gerd (2015); The development of THE INTERNATIONAL CODE OF SAFETY FOR SHIPS USING GASES OR OTHER LOW-FLASHPOINT FUELS (IGF CODE)—IMO MSC.391(95); Motorship Conference—Gas fuelled ships—Hamburg, 10/12 Nov. 2015

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For proofreading I like to thank Michael Wright, excelsior p.s., for his hard work. The parts which still sound German are my responsibility and definitely not related to his work.

Contents

Acronyms

API	American Petroleum Institute (USA Institution developing saftey standards in refinery industry)
BAM	Bundesanstalt für Materialforschung und –prüfung
BOG	Boil Off Gas
BOR	Boil Off Rate in %/*d* at 100% filling
CC	Carbon Capture
CCU	Carbon Capture and Use
CGA	Compressed Gas Association (USA Institution developing saftey standards for transport and use of flammable gases)
CH_3OH, C_2H_5OH	Methaol, Ethanol
CH_4	Methane
CNG	Compressed Natural Gas
CO_2	Carbon Dioxide
DEKRA	Deutscher Kraftfahrzeug-Überwachungs-Verein
DNV	Det Norske Veritas (Classification Society based in Norway)
Double-Block and Bleed	Is a valve arrangement with two block and one bleed valve
DQRDC	Dry Quick Release/Disconnect Coupling
ESD	Emergency Shut Down
ESD-Concept	Emergency Shut Down engine room concept according IGF-Code (2016), Sect. 5.6
ESD-ER	ESD engine room
EX-Z	Explosion Zone
FL	Tank Filling Limit at maximum permitted pressure
FMEA	Failure Mode and Effect Analysis
FR	Functional Requirement
FRs	Functional Requirements
FT	Fischer Tropsch
Gas-Save-ER	Gas safe or inherent safe engine room

GHG	Green House Gas
GVU	Gas Valve Unit
HAZID	HAZard IDentification study
HFO	Heavy Fuel Oil
IATA	The International Air Transport Association
IEC	INTERNATIONAL ECTROTECHNICAL COMMISSION
IEC-60079-10-1	Explosive gas atmospheres; IEC Standard 60079-10-1, 2021
IGC-Code	International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk
IGF-Code	International Code of Safety for Ships using Gases or other Low-Flashpoint Fuels
IGF-IG	IMO interim guidelines on gas as ship fuel
IMDG-Code	IMO International Maritime Dangerous Goods Code
LEL	Lower Explosion Limit
LFF	Low Flashpoint Fuel
LH_2	Liquefied Hydrogen
LL	Tank Loading Limit
LNG	Liquefied Natural Gas
LNH_3	Liquefied Ammonia
LPG	Liquefied Petroleum Gas (mixture of Propane unad Butane)
MARVS	Maximum Allowable Relief Valve Setting
MAWP	Maximum Allowable Working Pressure
MDO	Marine Diesel Oil (mixture of mainly destilate fuel with heavy oil)
MGO	Marine Gas Oil (destilate fuel)
MSC	IMO Marine Safety Committee
NH_3	Ammonia
NO_x	Nitrogen Oxide
Part-A1	IGF-Code (2016) Part-A1 “Specific requirements for ships using natural gas as fuel”
PM	Particulate Matter
PRV	Pressure Relief Valve
PRVs	Pressure Relief Valves
PtX	Power to X
PtX-FT	Power to X Fischer Tropsch fuel
PtX-LMG	Power to X Liquefied Methane Gas
QRA	Quantitative Risk Assessment
QRR	Qualitative Risk Ranking
SIGTTO	Society of Gas Tankers and Terminal Operators
SO_2	Sulphure Dioxide
SOLAS	Safety Of Life At Sea convention

S-QRA	Semi-Quantitative Risk Assessment
TÜV	Technischer Überwachungsverein
tank connection space	The tank connection space includes all tank connections of the fuell tank including the first valve outside of the tank
UN	United Nations
WG	Working Groups are set up by IMO committees to work on a subject during IMO meetings