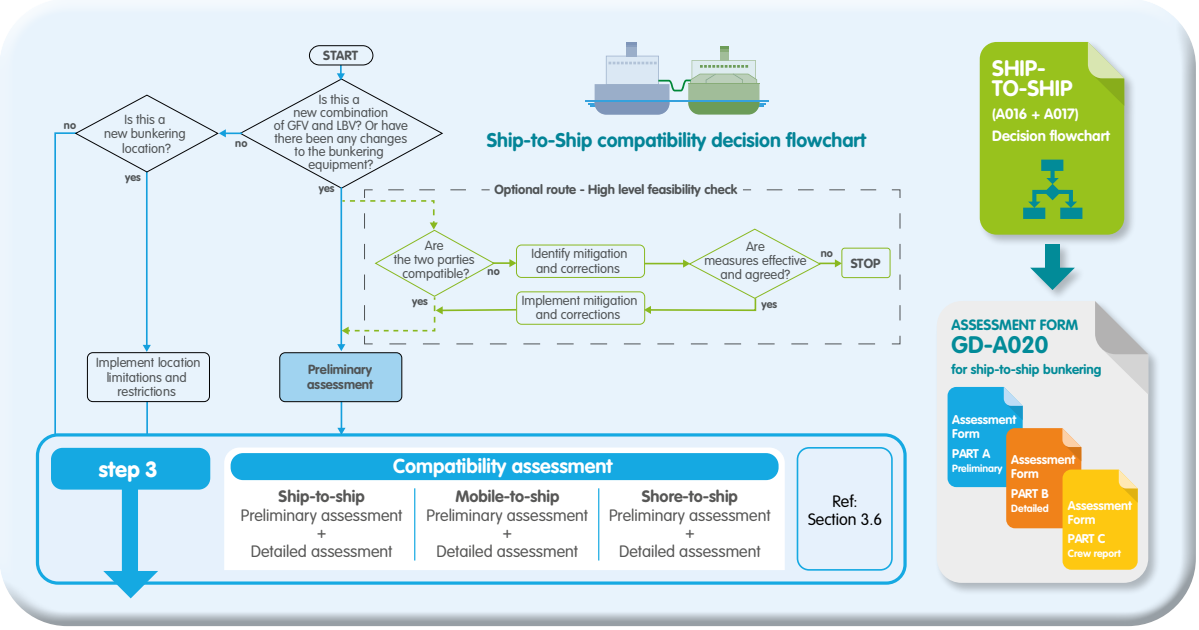
TGN19-01
version 1.0

LNG as a marine fuel

A Bunkering Compatibility Assessment Methodology



sgmf
the society for gas as a marine fuel

technical guidance note

TGN19-01
version 1.0

TGN-19-01 - Version 1.0, August 2023.

ISBN: 978-1-7395354-0-7

The Society for Gas as a Marine Fuel

The Society for Gas as a Marine Fuel (SGMF) is a non-governmental organisation (NGO) established to promote safety and good practice in the use of natural gas as a marine fuel. The society supports the wider use of gas as marine fuel by developing technical guidelines that encourage safe and responsible operations. More information on the society is available at: **https://sgmf.info**

Disclaimer

The advice in these guidelines is based on current good industry practice and available information. It is intended solely for guidance and use at the owner's/operator's own risk. No responsibility is accepted by SGMF – nor by any person, company or organisation related to SGMF – for any consequences resulting directly or indirectly from compliance with, or adoption of, any of the recommendations or guidance.

Notes

1. This document provides only recommendations. They are not intended to constitute a detailed technical specification. They apply only to the use of liquefied natural gas (LNG) on gas-fuelled vessels and to the interface with the bunkering facility. It is the responsibility of the respective owner/operator to:
   a. develop appropriate operational guidance for a specific gas-fuelled vessel, bunkering facility and their equipment and systems, based on the builder's and manufacturer's instructions and these recommendations
   b. ensure that any design specification meets the actual operational conditions to which the gas-fuelled vessel will be subjected over its asset lifetime
2. The recommendations and considerations in the ***Lessons learned*** sections represent only the collective experience of SGMF's membership on common issues and challenges that may arise during the use of LNG as a marine fuel and relating to the compatibility between a gas-fuelled vessel and bunkering facility:
   a. They are not intended to constitute a technical specification or to provide specific safety recommendations.
   b. Their application is left to the skilled design team and operator, who should evaluate which ones are applicable or not to their asset and, if so, under which circumstances.

Acknowledgements

SGMF acknowledges the participation of the following individuals and companies in developing this document: Sarah Rollings (Shell), Martin Mischke (formerly Gasum), Kenny English (Waves Group), Per Groeneveld (Seagic), Gary Olszewski (Vancouver Fraser Port Authority), Georgios Mezes (Hapag-Lloyd), Andrew Stafford (Trelleborg), Grant Wintle (CryoSafe Services), Dain Detillier (Harvey Gulf), Jasper de Jonge (Titan-LNG), Renate Westendorf (Port of Rotterdam), Lionel Martin (TotalEnergies), Tony Vollmers (BC Ferries), Alex Fairchild (Tote), Yongjun Jo (ABS), Stephen Gallagher (SGMF) and Gianpaolo Benedetti (SGMF).

SGMF also acknowledges the contributions of the following individuals and organisations: Emanuele Calcamuggi (Fratelli Cosulich LNG), Gilles Ranchoux (Shell), Matthijs van der Moer (DEME Group), Mikael Sandqvist (Manntek), Stuart Carpenter (Carnival) and Johan Lillieskold (Schulte).

Reader key

Clarifications and qualifications

Case studies/examples/ lessons learned

Codes/standards references

Foreword

From the first liquefied natural gas (LNG) bunkering operation through its rapid growth in recent years, the importance of compatibility between the bunkering facility and the receiving gas-fuelled vessel (GFV) remains pertinent and will continue to be critical to the success of our industry. SGMF through this publication helps us take a step further in the maturity of LNG as a marine fuel by standardising LNG bunkering compatibility and the assessment process.

Compatibility assessments are common in the conventional LNG carrier industry for Ship-to-Ship and cargo terminal operations, but the assessments for LNG bunkering operations differ significantly and require standardisation. The constantly increasing fleet of GFVs has imposed challenges for the bunker suppliers to process the required technical information to ensure compatibility with their bunkering facilities. Similarly, technical managers of GFVs are often asked to provide the same information to multiple suppliers in a variety of formats, resulting in a growing workload for both suppliers and receivers. This is why the standardisation and simplification of the process is essential. *Bunkering Compatibility Assessment Methodology* provides clear guidance on compatibility and the assessment process to produce time efficient and safe assessment results.

The basis for conducting a compatibility assessment focuses on the key interface elements that support the safe and successful transfer of LNG as a marine fuel. These key elements include mooring, bunkering systems, connections and safety links, boil-off gas capabilities, safety and hazardous zones, and simultaneous operations (SIMOPs). The associated forms, free to download from the SGMF website, used in conjunction with this base document address the key project management questions.

As the industry evolves the learning process, the drive towards standardisation will continue. The members of Working Group 19 (WG 19) were at the forefront of understanding the significance of compatibility to ensure the efficient and safe transfer of LNG as a marine fuel. Their expertise, insight and experience are invaluable to our industry. Through this publication and its associated forms, they have shared their knowledge and lessons learned for others to build on in their respective internal processes and as the industry continues to mature.

LNG is lower in carbon emissions than conventional fuels, and as the maritime pursues its drive towards decarbonisation LNG will continue to have a positive impact with a strong role in the energy transition. Developing sustainable practices such as this compatibility assessment process will contribute to the uptake and confidence in alternative fuels that will help us achieve a net zero emissions future.

Sarah Rollings
Shell
Strategic Account Manager, Marine Decarbonization and SGMF Working Group Chairperson

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Abbreviations

The following abbreviations are used in this document:

BOG – Boil-off gas

BSL – Bunkering safety link

DD-CC – Dry disconnect and connect coupling

ERC – Emergency release coupler

ESD – Emergency shutdown

GFV – Gas-fuelled vessel

IGF Code – International Code of Safety for Ships Using Gases or Other Low-flashpoint Fuels

IMO – International Maritime Organization

JBP – Joint bunkering plan

LBO – LNG bunkering organisation

LBV – LNG bunker vessel

LNG – Liquefied natural gas

MARVS – Maximum allowable relief valve tank settings

PRV – Pressure relief valve

RSO – Receiving ship operator

SMS – Safety management system

STS – Ship-to-ship

SWL – Safe working load

Definitions

The following definitions are used throughout this document.

Boil-off gas (BOG)
The vapour created when liquefied gas evaporates.

Bunkering checklist
The bunkering checklist is a mutual document that contains steps to be taken and confirmed by both the supplier and receiver before and during the bunkering operation.

Bunkering compatibility assessment
This is a process to confirm that the physical and operational interfaces between the bunkering facilities and the receiving gas-fuelled vessel are compatible so that bunkering can be completed safely.

The assessment should confirm that there is no aspect that prevents the LNG bunkering operation from taking place or introduces additional risks, and it should provide any recommendations needed to ensure interface compatibility.

Bunkering facility
Any technology or system designed to be used to transfer/bunker liquefied gas as fuel to a gas-fuelled vessel. It usually consists of a bunker vessel, road tanker or terminal.

Bunker station
The location(s) on board a vessel from which non-cargo fluids are loaded and discharged to a bunkering facility.

Compatibility
In this document compatibility is specific to bunkering compatibility, i.e. the physical and operational interfaces between the bunkering facilities and the receiving gas-fuelled vessels that allow transfer of LNG as fuel.

Competent authority
In this document, the general term 'competent authority' describes an organisation with jurisdiction over the location, operation and/or assets involved.

The competent authority can have a legal, operational and location-specific interest over the operation and related activities. It can have a statutory function and may enforce requirements, rules and standards.

Different organisations, or more than one organisation, may act as a competent authority, depending on the activity being undertaken.

Emergency shutdown (ESD) (Bunkering)
The bunkering emergency shutdown is the event, signal or process initiated in an emergency to shut down the bunkering operation.

The process is divided into two consecutive stages: ESD-1 and ESD-2.

- The first stage, ESD-1, is intended to stop the flow in a controlled manner. The initiation of an ESD-1 process does not imply that an ESD-2 process will be initiated soon after.

- The second stage ESD-2 process is primarily intended to protect the bunkering transfer system, equipment and ship's manifold should the vessel drift out of a predetermined operating envelope. The ESD-2 release is usually initiated by the bunkering facility either automatically or manually.

Gas-fuelled vessel (GFV)
An IGF-compliant vessel using natural gas as marine fuel.

HAZard and OPerability study (HAZOP)
A HAZard and OPerability study is a qualitative technique based on guidewords, which provides a detailed,

systematic examination – by a group of multidisciplinary specialists – of components within a system to determine what would happen if a particular component were to fail or operate outside its normal design mode.

HAZard IDentification (HAZID)
A HAZard Identification study is the process of identifying hazards – performed by a group of specialists in a systematic way – to plan for, avoid, or mitigate their impacts. Many specific methods are available.

Hazardous area/zone
The three-dimensional space in which a combustible or explosive atmosphere can be expected to be present frequently enough to require special precautions for the control of potential ignition sources.

Joint bunkering plan (JBP)
The joint bunkering plan (JBP) is a mutual short summary document that contains essential information about a specific bunkering operation from a bunkering facility and a gas-fuelled vessel in a defined location. This document is typically requested by local competent authorities such as ports, that follow the International Association of Ports and Harbors (IAPH) bunkering checklist framework.

Licence (Bunkering)
In this document, the general term 'licence' describes a permit, licence, or approval generally required for the bunkering facilities and gas-fuelled vessel which allows the LNG bunkering operations to go ahead in an area under the jurisdiction of a competent authority from which the licence should be obtained. It should be noted that some competent authorities might refer to this as approval, permit, permission or letter of no objection to bunker.

LNG bunkering
The process of re-fuelling an LNG-powered vessel from a bunkering facility.

LNG bunkering organisation (LBO)
The organisation that staffs and operates a bunkering facility.

Person-in-charge (PIC)
The individual responsible for managing the bunkering operation on behalf of either the bunkering facility or the gas-fuelled vessel. One PIC might act as the person-in-overall-advisory-control (POAC).

Receiver
In this document, 'receiver' is a general term used to refer to one or more organisations with ownership, operational and/or legal interests in a gas-fuelled vessel. The receiver may be the vessel owner(s), charterer or operator.

Receiving ship operator (RSO)
The organisation staffing and operating a gas-fuelled vessel.

Safety zone
The safety zone can be defined as the three-dimensional envelope of distances inside which the majority of leak events occur, and where, in exceptional circumstances, there is a recognised potential for a leak of natural gas or LNG that could harm life or damage equipment/infrastructure.

SIMultaneous OPerations (SIMOPs)
Defined in this document as 'LNG bunkering plus one, or more, other independent operations conducted together within the control of the PIC(s), where the operations may impact, or increase impacts, on personnel safety, ship integrity and/or the environment'.

Supplier
The 'supplier' is the fuel owner or organisations mandated by them for the operation or development of a bunkering activity.

Technical Guidance Note (TGN)
SGMF publishes Technical Guidance Notes for the industry, which are referred to in this publication as required.

Vapour
The gaseous phase of liquefied gas.

Purpose

In any bunkering supply scenario, the bunkering interfaces – of which the bunkering transfer system is a main part – are a key factor in determining compatibility between supplier and receiver and ultimately the success of any bunkering operation.

A lack of proper understanding of what needs to be done or efficient methodology to ensure compatibility between a receiving gas-fuelled vessel and a supplying bunkering facility (i.e. a bunker vessel, a road tanker or bunkering terminal) is currently one of the main barriers to responsible and efficient LNG bunkering operations.

This Technical Guidance Note (TGN) aims to address this matter by providing guidance on how to assess compatibility between a bunkering facility and a gas-fuelled vessel, on how to gather information for such an assessment and on what needs to be checked and reported.

Recommendations are provided to ensure that the compatibility challenge is properly considered from the early stages in the design of the systems and of the bunkering operation, through operational procedures, testing and checking.

The document answers the most common questions about the need for a compatibility assessment and checks. It also proposes a balanced approach and process to satisfy the requirements for compatibility to a standard level for the industry. The publication is supported by lessons learned that promote industry good practice and form a basis for common understanding between the main stakeholders involved, specifically:

- LNG bunkering organisations
- receiving ship operators
- competent authorities
- the crew and personnel involved in the bunkering operation, and
- the designers of the vessel and its bunkering equipment

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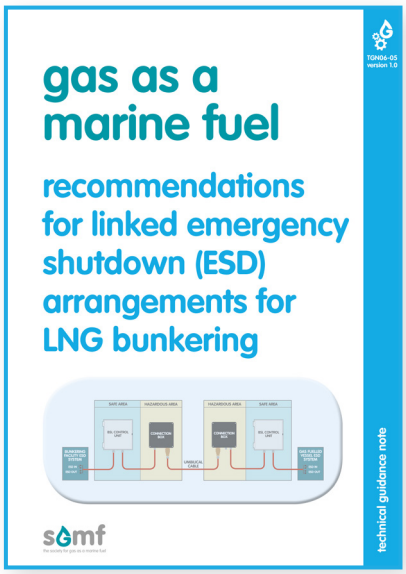

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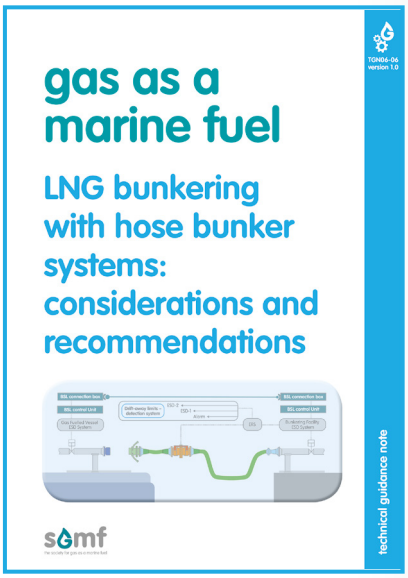

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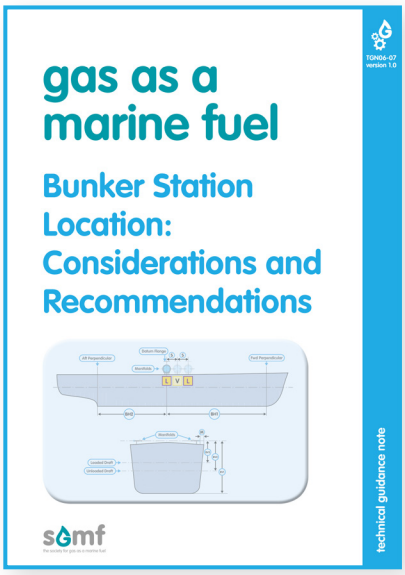

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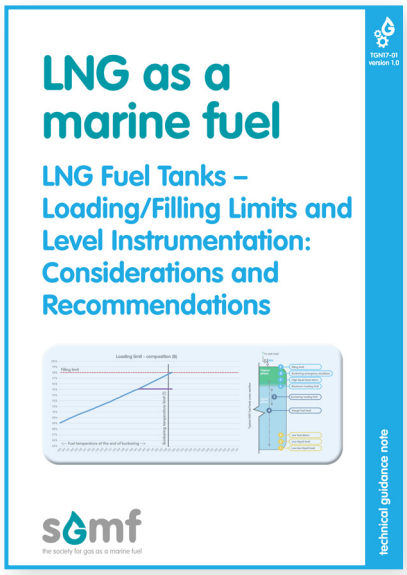

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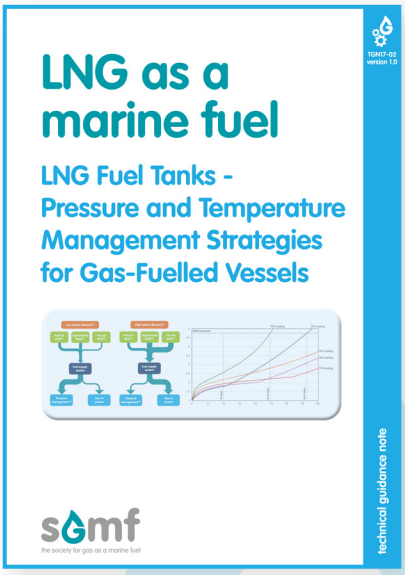

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