

STANDARD

DNVGL-ST-0026:2014-04

Competence related to the on board use of LNG as fuel

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FOREWORD

The standards lay down technical requirements and acceptance criteria to the object in question, e.g. vessels, offshore units and installations.

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Any comments may be sent by e-mail to rules@dnvgl.com

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CHANGES – CURRENT

General

This DNV GL document supersedes and replaces the previous legacy DNV Standard for Certification No. 3.325, April 2013.

Text affected by the main changes in this edition is highlighted in red colour. However, if the changes involve a whole chapter, section or sub-section, normally only the title will be in red colour.

On 12 September 2013, DNV and GL merged to form DNV GL Group. On 25 November 2013 Det Norske Veritas AS became the 100% shareholder of Germanischer Lloyd SE, the parent company of the GL Group, and on 27 November 2013 Det Norske Veritas AS, company registration number 945 748 931, changed its name to DNV GL AS. For further information, see www.dnvgl.com. Any reference in this document to “Det Norske Veritas AS”, “Det Norske Veritas”, “DNV”, “GL”, “Germanischer Lloyd SE”, “GL Group” or any other legal entity name or trading name presently owned by the DNV GL Group shall therefore also be considered a reference to “DNV GL AS”.

Main changes

- This standard has been updated to comply with the DNV GL merger and has been updated with cross references to comply with the new numbering system.

Editorial corrections

In addition to the above stated main changes, editorial corrections may have been made.

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SECTION 1 INTRODUCTION

1.1 Introduction

The standard aims to cover important aspects related to the use of liquefied natural gas (LNG) as a fuel on board vessels. Depending on the role or position on board the suggested competence level may differ. Specific details related to ship-specific arrangements / systems cannot be captured in a standard of a general nature. However the standard aims to provide guidance for establishing a competence foundation, both for vessels with pressure tanks and atmospheric tanks, to be supplemented by e.g. operational / supplier manuals. The standard aims to identify a base set of competencies for key personnel involved in LNG-related activities on board.

1.2 Scope

The standard identifies a suggested minimum level of knowledge and skills for people in various roles on board a vessel using LNG as fuel. This standard can be used in the following ways:

- As a reference to familiarise or assess people in their specific role in relation to LNG.
- As a reference for global competence and defining training requirements.
- As a guide to training providers, who are to develop courses according to the requirements of the standard and needs of the industry.
- As a reference document for e.g. certification of personnel.

Standard equipment is supposed to be covered by current competence. (e.g. engines, heating system, compressors). Detailed competence in relation to e.g. fire-fighting and first aid is not covered in this standard.

The standard does not contain competence requirements for LNG cargo operators for vessels involved in transporting LNG as cargo. These can be found in DNV GL competence standard DNV GL-ST-0010 *Competence of shipboard LNG cargo operators*.

1.3 Target groups

The Target Groups below are based on the categories introduced in Resolution IMO MSC. 285(86).

CATEGORY	TARGET GROUP
Category A - BASIC	Basic competence for ALL officers / crew, regardless of role or function
Category B - DECK	Competence requirements for deck officers / operational deck crew
Category C - ENGINE	Competence requirements for engine officers / operational engine crew

The determining factor for selecting the required level of competence should always be the role, task or responsibility assigned to a person. It is the responsibility of the ship-owner to ensure that the right people possess the right competence.

The target group is considered to possess a thorough knowledge and understanding of regular equipment used on vessels.

1.4 Professional profile

The crew on board an LNG-fuelled vessel must be able to recognise risks and be aware of specific points of attention related to LNG and operate the systems related to this. In addition they must be able to perform LNG-bunkering operations (shipboard) in a safe and controlled manner, recognise potential problems and handle emergency situations related to LNG.

1.5 Required performance standard

The performance standard describes how well or to what level of detail the crew should perform their duties and tasks related to LNG. All performance criteria are aimed at risk reduction and a constant safety awareness is considered a basic condition to work with or in the vicinity of LNG.

The crew will comply with all international, national and local regulations and requirements and the vessel and equipment shall be operated safely without damage to life, environment or property.

SECTION 2 TAXONOMY

2.1 General

Taxonomy of behaviour specifies the level on which the person should be able to function on a professional level.

It is a hierarchical arrangement in four (4) levels of what a person has to master from simple to complex requirements, based on instructional design principles.

For every next level, it is a prerequisite that the preceding level is mastered. The required professional behaviour is expressed by means of a verb.

2.2 Levels of cognition

Each competence requirement can be classed by the level of cognition required to meet the competence requirement.

Level 1: knowledge (K)	To remember or to reproduce on basis of appropriate, previously learned information.
Level 2: understanding (U)	To give meaning to new situations and or new material by recollection and using necessary present information. To give evidence of insight in certain activities.
Level 3: application (A)	To use previously acquired information in new and concrete situations to solve problems that have single or best answers.
Level 4: integration (I)	To separate information into their component parts, to examine such information to develop divergent conclusions by identifying motives or causes, making inferences, and or finding evidence to support generalizations. To creatively apply prior knowledge and skills to produce a new or original whole. To judge the value of material based on personal values or opinions, resulting in an end product, with a given purpose, without real right or wrong answers.

2.3 Professional behaviour verbs

The lists of verbs in the table below are not exhaustive and should be used as guidance only.

<i>Level of cognition</i>	<i>Relevant action verbs</i>
Knowledge (K)	Choose, cite, describe, distinguish, find, give example, group, identify, indicate, know, label, list, listen, locate, match, memorise, name, outline, quote, read, recall, recognise, record, recite, relate, repeat, reproduce, retrieve, review, select, show, sort, state, underline, write
Understanding (U)	Account for, annotate, associate, check, classify, compare, define, describe, discuss, estimate, explain, give examples, give main idea, identify, infer, interpret, observe, outline, paraphrase, recognise, reorganise, report, restate, retell, research, review, summarise, translate
Application (A)	Adapt, apply, arrange, calculate, carry out, change, collect, compute, conclude, construct, demonstrate, dramatise, draw, exhibit, execute, extract, illustrate, implement, include, instruct, interpret, interview, make, manipulate, obtain, operate, paint, practice, prepare, sequence, show, sketch, solve, translate, use
Integration (I)	Analyse, appraise, argue, arrange, assess, attribute, calculate, categorise, check, choose, combine, compare, contrast, criticise, critique, debate, decide, deconstruct, deduce, defend, design, detect, determine, develop, diagram, differentiate, discriminate, dissect, distinguish, evaluate, examine, experiment, find, formulate, group, hypothesise, infer, investigate, integrate, interpret, inspect, inquire, judge, justify, measure, monitor, order, organise, outline, plan, predict, prioritise, probe, question, rank, rate, recommend, reject, relate, research, revise, score, separate, select, sequence, sift, structure, survey, tell why, test, validate, value, verify

SECTION 3 COMPETENCE TABLE

Each competence requirement indicates a level of knowledge or understanding regarding a certain topic or task. The competence requirements are stated in objective format to clearly define what is expected from a person. This also facilitates the derivation of learning objectives for training or familiarisation programs as well as assessment criteria to measure individual competencies.

The categorisation as described under [1.3] is captured in one integrated competence table, Table 3-1 below.

The table displays the competence requirements / competence statements indicated per category:

- Category A: Basic – All functions
- Category B: Deck officers / operational deck crew
- Category C: Supplement for engine officers / operational engine crew

Each competence requirement is allocated a level of cognition that can be used to determine the type of assessment required to measure competence.

Each competence requirement is then linked to the applicable categories.

The competence requirements for an officer or crewmember working on an LNG-fuelled vessel include theoretical knowledge, intellectual skills and physical skills.

Table 3-1 Competence requirements

Column 1 shows the ID for the competence Column 2 is the defining activity for the competence Column 3 defines the level of competence required Column 4 indicates the applicability for Category A: Basic – all functions Column 5 indicates the applicability for Category B: Operational deck Column 6 indicates the applicability for Category C: Operational engine					
1	2	3	4	5	6
1	GENERAL KNOWLEDGE AND UNDERSTANDING				
1.1	Physics and chemistry				
1.1.1	Explain what LNG is	U	•	•	•
1.1.2	Explain how LNG differs from other marine fuels	U	•	•	•
1.1.3	Explain the relationship between pressure and temperature	U	•	•	•
1.1.4	State the storage-temperature of LNG	K	•	•	•
1.1.5	State the flashpoint, lower explosive limit, upper explosive limit and auto-ignition temperature of LNG	U	•	•	•
1.1.6	Explain what happens when opening a valve used to contain LNG	U	•	•	•
1.1.7	Explain the term 'rapid phase transition'	U	•	•	•
1.1.8	Explain the term 'dew point' and 'bubble point' in relation to nitrogen and how this affects LNG	U	•	•	•
1.1.9	Describe 'boil off gas'	U	•	•	•
1.1.10	Describe the term 'vapour buoyancy'	U	•	•	•
1.1.11	State the applicable rules and regulations related to the use of LNG in the maritime sector	K	•	•	•
1.2	Risk awareness, health and safety				
1.2.1	Interpret the Material Safety Data Sheet for LNG	I	•	•	•
1.2.2	Describe the hazards associated with handling LNG (e.g. asphyxia, low temperatures)	U	•	•	•
1.2.3	Explain the risk of expanding trapped liquid / BLEVE	U	•	•	•
1.2.4	Describe the hazardous areas / EX-zones on board in relation to LNG and operational limitations in those areas	U	•	•	•
1.2.5	Explain the Joule-Thomson effect and the risks it presents (pressurized systems only)	U	•	•	•
1.2.6	Explain the term 'cryogenic' and the risks it presents for humans	U	•	•	•
1.2.7	Perform basic first aid in case of injuries / physical problems due to LNG exposure	A	•	•	•

Table 3-1 Competence requirements (Continued)

Column 1 shows the ID for the competence Column 2 is the defining activity for the competence Column 3 defines the level of competence required Column 4 indicates the applicability for Category A: Basic – all functions Column 5 indicates the applicability for Category B: Operational deck Column 6 indicates the applicability for Category C: Operational engine					
1	2	3	4	5	6
1.2.8	Describe how the cryogenic properties of LNG affect standard steel components upon contact	U	•	•	•
1.2.9	Demonstrate the use of appropriate personal protective aids when working with LNG	A	•	•	•
1.2.10	Demonstrate the use of available rescue and escape equipment	A	•	•	•
1.2.11	Describe the behaviour of LNG when discharged (into water / on ground)	U	•	•	•
1.2.12	Recognise the environmental impact of an operational release of LNG as compared to a release of a similar quantity of CO ₂	U	•	•	•
1.2.13	Explain the risks of entering spaces containing nitrogen systems	U	•	•	•
1.2.14	Explain risks of entering spaces with high pressure cryogenic pumps	U	•	•	•
2	THE STORAGE SYSTEM				
2.1	<i>Bunker tanks</i>				
2.1.1	Describe the different tanks used for LNG containment (e.g. membrane, independent types)	U		•	•
2.1.2	Explain the layout and operation of the tank-system	U		•	•
2.1.3	Describe indicators of leaks in the insulation system	U		•	•
2.1.4	Describe pressure holding times of the bunker-tanks / system	U		•	•
2.1.5	Explain the importance of monitoring hold space atmosphere	U		•	•
2.1.6	Describe methods of cooling down tanks	U		•	•
2.1.7	Perform inspections of the bunker support system	A			•
2.1.8	Perform inspections of the insulation system	A			•
2.1.9	Adjust valves not to exceed desired cooling down rate	A			•
2.1.10	Interpret process descriptions of special tank operations	I			•
2.1.11	Interpret readings from instruments / control system	I			•
2.1.12	Operate bunker tank valves	A			•
2.2	<i>Bunker transfer arrangement</i>				
2.2.1	Explain the importance of drip-trays being kept free of (rain)water before commencing bunkering (if applicable)	U	•	•	•
2.2.2	Verify drip-tray drains are closed prior to LNG service (if applicable)	A		•	•
2.2.3	Describe the loading arrangement for bunkering LNG	U		•	•
2.2.4	State the maximum loads / limitations of the loading arrangement (vessel-side)	K		•	•
2.2.5	Estimate the required free space and trajectory for the loading arrangement	A		•	•
2.2.6	Verify fendering does not interfere with the bunker transfer arrangement	A		•	•
2.2.7	Recognise the movement limitations of the bunker transfer arrangement	K		•	•
2.2.8	Explain the difference between high pressure and low pressure gas supply systems (pressurized / atmospheric)	U		•	•
2.2.9	Prepare the line-up for bunker transfer	A			•
2.2.10	Operate the manifold	A			•
2.2.11	Operate the strainers	A			•
2.2.12	Run cool down procedure (if applicable)	A			•
2.2.13	Adjust valves in a correct manner during the cool down procedure	A			•
2.2.14	Interpret bunkering transfer diagrams	I			•

Table 3-1 Competence requirements (Continued)

Column 1 shows the ID for the competence Column 2 is the defining activity for the competence Column 3 defines the level of competence required Column 4 indicates the applicability for Category A: Basic – all functions Column 5 indicates the applicability for Category B: Operational deck Column 6 indicates the applicability for Category C: Operational engine						
1	2	3	4	5	6	
2.3	<i>Tank connection space</i>					
2.3.1	Describe the function of the tank connection space	U	•	•	•	
2.3.2	Recognise the increased risk of gas leakage in the tank connection space	K	•	•	•	
2.3.3	Describe the safe working procedure for working in the tank connection space	U	•	•	•	
2.4	<i>Pressure control</i>					
2.4.1	Describe the equipment used for measuring pressure	U		•	•	
2.4.2	Interpret pressure readings (e.g. system components, nitrogen batteries)	I		•	•	
2.4.3	Perform inspections, tests and routine calibration on pressure-monitoring equipment	A			•	
2.4.4	Perform checks and maintenance on pressure controllers, pressure transmitters and pressure relief valves	A			•	
2.4.5	Explain the terms Operating pressure, Pressure Alarm High (PAH) and Pressure Alarm Low (PAL).	U			•	
2.5	<i>Temperature monitoring</i>					
2.5.1	Describe the equipment used for temperature monitoring	U		•	•	
2.5.2	Interpret readings from temperature monitoring equipment	I		•	•	
2.5.3	Perform inspections, tests and routine calibration of temperature monitoring equipment	A			•	
2.6	<i>Level gauging systems</i>			•	•	
2.6.1	Interpret readings from level gauging equipment	I		•	•	
2.6.2	Describe the equipment used for overfill protection	U		•	•	
2.6.3	Interpret readings from overfill protection equipment	I		•	•	
2.6.4	Explain principle and method of operation of various types of Level Gauging Systems	U		•	•	
2.6.5	Explain likely problems of the various Level Gauging Systems	U		•	•	
2.6.6	Perform inspections, tests and routine calibration on level gauging equipment	A			•	
2.6.7	Perform inspections, tests and routine calibration on overfill protection equipment	A			•	
3	THE GAS SUPPLY SYSTEM					
3.1	<i>Repairs and exchanging parts</i>					
3.1.1	Explain the importance of using stainless steel in piping and equipment	U	•	•	•	
3.1.2	Explain why improvised solutions using non-standard parts are dangerous	U	•	•	•	
3.1.3	Verify if the vessel has proper equipment on board to repair stainless steel piping	A		•	•	
3.2	<i>Cryogenic valves and pumps</i>					
3.2.1	Explain the design and construction of cryogenic valves	U		•	•	
3.2.2	Explain operation of cryogenic pumps in high pressure gas supply systems	U		•	•	
3.3	<i>Gas isolation valves (Double block / bleed arrangement)</i>					
3.3.1	Perform routine-tests on gas isolation valves / double block and bleed arrangement	A			•	
3.3.2	Interpret test results of gas isolation valves / double block and bleed arrangement	I			•	
3.3.3	Recognise high differential pressure (High pressure control valve)	K			•	

Table 3-1 Competence requirements (Continued)

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1	2	3	4	5	6
3.4	<i>High pressure pumps</i>				
3.4.1	Operate a high pressure reciprocating plunger fuel injection pump	A			•
3.4.2	Monitor pump readings	A			•
3.4.3	Perform the cooling down procedure	A			•
3.4.4	Perform maintenance on a high pressure pump	A			•
3.5	<i>In-tank pumps (Atmospheric systems only- if applicable)</i>				
3.5.1	Explain the setup and operation of in-tank pumps	U		•	•
3.5.2	Recognise the critical importance of maintaining gas tight cable penetration	K		•	•
3.5.3	Start up the in-tank pumps	A			•
3.5.4	Interpret readings related to the operation of in-tank pumps	I			•
3.5.5	State the minimum flow required for cooling purposes	K			•
3.5.6	Recognise the critical importance of maintaining gas tight cable penetration	K			•
3.6	<i>Spray pumps (Atmospheric systems only-if applicable)</i>				
3.6.1	Explain the purpose of spray pumps	U		•	•
3.6.2	Operate the spray pump(s)	A			•
4	THE LNG MONITORING SYSTEM				
4.1	<i>Control and alarm board</i>				
4.1.1	Interpret readings from the process control system	I			•
4.1.2	Perform fault-finding related to the control and alarm board	A			•
4.1.3	Perform troubleshooting related to the control and alarm board	A			•
4.2	<i>Vapour control</i>				
4.2.1	Describe methods for handling vapours from cooling down	U		•	•
4.2.2	Describe limitations for venting off vapours	U		•	•
4.2.3	Explain where to return the vapours during gas-freeing and warming up	U		•	•
4.2.4	Perform a manual emergency vapour release	A			•
5	VENTING AND VENTILATION				
5.1	<i>Importance of venting and ventilation</i>				
5.1.1	Explain the critical importance of a functioning ventilation system to ensure provision of LNG to the engine	U	•	•	•
5.1.2	Explain the importance and the function of air locks	U	•	•	•
5.1.3	Explain the use of positive pressure and negative pressure at various places in the system	U		•	•
5.1.4	Explain the importance of relative negative pressure in the gas dangerous areas	U		•	•
5.1.5	Perform checks related to positive pressure and negative pressure conditions and equipment	A			•
5.1.6	Adjust differential pressure switches when needed	A			•

Table 3-1 Competence requirements (Continued)

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1	2	3	4	5	6	
5.2	<i>Double walled piping</i>					
5.2.1	Explain the importance and purpose of double-walled piping	U	•	•	•	
5.2.2	Perform inspection and leak-tests on double-walled piping	A			•	
5.2.3	Describe how to handle double-walled piping during dis-assembling and re-assembling	U			•	
5.2.4	Perform maintenance on double-walled piping	A			•	
5.3	<i>Fuel Gas venting system</i>					
5.3.1	Explain why vent outlets should be regarded as potentially hazardous zones	K	•	•	•	
5.3.2	Describe actions in case of ignited vents	U	•	•	•	
5.3.3	Recognise the importance of reporting safety vent releases to engine department	U	•	•	•	
5.3.4	Monitor vent piping system for explosive atmosphere	A			•	
5.3.5	Determine if trapped liquid releases consist of water or LNG	A			•	
5.3.6	Describe the proper procedure if the trapped liquid consists of LNG	U			•	
5.3.7	Describe the proper procedure if the trapped liquid consists of water	U			•	
5.3.8	Interpret the level / temperature readings of liquid releases in the fuel gas venting system	I			•	
6	COMPRESSORS					
6.1	<i>High duty compressors</i>					
6.1.1	Explain the purpose and principles of operation of High Duty Compressors	U		•	•	
6.1.2	Operate a High Duty Compressor (Setting up, Starting, Automatic control, Shutdown)	A			•	
6.1.3	Explain the presence of dissolved gas in lubrication oil used in the high duty gas compressor	U		•	•	
6.1.4	Describe the potential danger of dissolved gas in case of maintenance of the high duty gas compressor	U		•	•	
6.1.5	List lubrication requirements of High Duty Compressors	K			•	
7	SAFETY SYSTEMS AND COMPONENTS					
7.1	<i>Gas detection system</i>					
7.1.1	Describe the gas detection system on board	U	•	•	•	
7.1.2	Maintain an adequate inventory of spare-parts to ensure continuity of the gas detection system	A		•	•	
7.1.3	Explain the operation of the interlocks as part of the gas detection and gas control system	U			•	
7.1.4	Calibrate the gas detection system	A			•	
7.1.5	Perform maintenance on the gas detection system	A			•	
7.2	<i>Emergency shutdown system</i>					
7.2.1	Describe the consequences of activating an ESD call-button	U	•	•	•	
7.2.2	Explain the operation and triggers of the Emergency Shutdown System	U		•	•	
7.2.3	Explain the Emergency Shutdown Sequence	U		•	•	
7.2.4	Perform Emergency Shutdown tests	A		•	•	
7.2.5	Perform inspection and maintenance on ESD-valves	A			•	
7.2.6	Explain the difference between the ER safety system principles 'Emergency Shutdown' and 'Inherently safe'	U			•	

Table 3-1 Competence requirements (Continued)

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1	2	3	4	5	6
7.3	<i>Safety relief valves</i>				
7.3.1	Explain the working principle of safety relief valves	U	•	•	•
7.3.2	Perform inspections and tests on safety relief valves (qualified people only)	A			•
7.3.3	Perform maintenance on safety relief valves (qualified people only)	A			•
7.3.4	Perform the emergency closing procedure of safety relief valves	A			•
7.4	<i>Fire detection system</i>				
7.4.1	Describe the components of the fire detection system	U	•	•	•
7.5	<i>Portable gas detection equipment</i>				
7.5.1	Explain purpose and principles of operation of different portable gas detection instruments	U		•	•
7.5.2	Calibrate and use portable gas detection equipment (oxygen, methane)	A		•	•
7.5.3	Calibrate and use a dew-point meter	A			•
7.6	<i>EX-certified equipment</i>				
7.6.1	Describe locations where EX-proof lighting and equipment is required	U	•	•	•
7.6.2	Perform inspection, maintenance and repair of EX-certified equipment (certified people only)	A			•
7.6.3	Explain the specific maintenance requirements for EX-proof fans	U			•
7.6.4	Interpret a wiring diagram of an EX-certified instrument	I			•
7.6.5	Connect a motor in EX-mode	A			•
7.6.6	Replace EX-barriers in I/O modules	A			•
7.6.7	Maintain inventory of EX-certified spare parts, based on the criticality in relation to LNG-related components	A			•
8	AUXILIARY SYSTEMS				
8.1	<i>Inert gas generator (if applicable)</i>				
8.1.1	Define principles of operation of an Inert Gas Generator	U		•	•
8.1.2	Define 'Inert Gas' and its requirements	U		•	•
8.1.3	Operate an inert gas generator to supply dry air of appropriate quality	A			•
8.2	<i>Nitrogen generation and distribution (if applicable)</i>				
8.2.1	Define principles of operation of a nitrogen generator	U		•	•
8.2.2	Explain how the nitrogen injection and purging arrangement works	U		•	•
8.2.3	Explain when the nitrogen injection and purging arrangement should be operational	U		•	•
8.2.4	State the maximum allowable percentage of oxygen in the mix	K		•	•
8.2.5	Describe nitrogen outlet requirements	U		•	•
8.2.6	Operate the nitrogen generator	A			•
8.2.7	Perform maintenance on the nitrogen generator	A			•
8.2.8	Operate the air compressor used for nitrogen generation and distribution	A			•
8.2.9	Perform maintenance on the air compressor used for nitrogen generation and distribution	A			•
8.2.10	Operate the booster compressor	A			•
8.2.11	Perform maintenance on the booster compressor	A			•
8.2.12	Take appropriate action in case of nitrogen quality problems	A			•

Table 3-1 Competence requirements (Continued)

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1	2	3	4	5	6
8.3	<i>Air and inert gas dryers (if applicable)</i>				
8.3.1	Explain the purpose and operating principles of Air and Inert Gas Dryers	U		•	•
8.3.2	Describe the tank conditioning method 'drying' and its importance	U		•	•
8.3.3	Describe the tank conditioning method 'inerting' and its importance	U		•	•
8.3.4	Operate the Air and Inert Gas Dryer	A			•
8.3.5	Perform maintenance on the Air and Inert Gas Dryer	A			•
8.4	<i>Gas heaters</i>				
8.4.1	Define principles of operation and purpose of Gas Heaters	U		•	•
8.4.2	Operate Gas Heaters (Setting up, Starting, Shutdown)	A			•
8.4.3	Adjust the flow of a gas heater	A			•
8.4.4	Monitor the outlet temperature of a gas heater	A			•
8.5	<i>Vaporisers</i>				
8.5.1	Explain the purpose of a Forcing Vaporiser	U		•	•
8.5.2	Explain the purpose of a LNG Vaporiser	U		•	•
8.5.3	Operate a Forcing Vaporiser (Setting up, Starting, Monitoring, Shutdown)	A			•
8.5.4	Operate a LNG Vaporiser (Setting up, Starting, Monitoring, Shutdown)	A			•
8.5.5	Describe how vaporizers are protected from freezing	U			•
8.5.6	Adjust system settings if required to protect vaporisers from freezing	A			•
8.6	<i>Water curtain (if applicable)</i>				
8.6.1	Explain purpose and operation of a Water Curtain	U		•	•
8.6.2	Perform maintenance on the water curtain system	A			•
8.7	<i>Control air</i>				
8.7.1	State important checks in determining the quality of control air	K		•	•
9	BUNKERING				
9.1	<i>Bunkering preparations</i>				
9.1.1	Describe the tasks and responsibilities of both crew and bunkering personnel during preparation and bunkering operation	U		•	•
9.1.2	Determine the condition of the bunker-tanks	A		•	•
9.1.3	Agree pre-bunkering formalities and operational alignment between ship and bunker operator in line with port regulations (pre-bunkering/compatibility checklist, communication lines)	A		•	
9.1.4	Agree emergency actions in combination with shore in case of emergencies	A		•	
9.1.5	Determine the vapour-handling capacities of bunker provider and own vessel	A		•	•
9.1.6	Determine the pressure levels of the nitrogen batteries to ensure adequate supply for the bunkering operation	A		•	•
9.1.7	State the acceptable pump-rates during the bunker-transfer	K		•	•
9.1.8	State the determining factors for using the vapour return system (if applicable)	K		•	•
9.1.9	Determine tank sequence for bunkering	A		•	•

Table 3-1 Competence requirements (Continued)

Column 1 shows the ID for the competence Column 2 is the defining activity for the competence Column 3 defines the level of competence required Column 4 indicates the applicability for Category A: Basic – all functions Column 5 indicates the applicability for Category B: Operational deck Column 6 indicates the applicability for Category C: Operational engine					
1	2	3	4	5	6
9.1.10	Discuss the need for using insulation flanges as opposed to bonding wires	U		•	•
9.1.11	Explain the importance of earthing / grounding	U		•	•
9.1.12	Describe measures taken on board to ensure proper grounding and static discharge during operations / bunkering	U		•	•
9.1.13	Determine the need for inerting of the filling lines in prior to the bunker transfer	A		•	•
9.1.14	Determine the need for purging of the filling lines in prior to the bunker transfer	A		•	•
9.2	<i>Bunker transfer</i>				
9.2.1	Describe the physical properties of bunkers	U		•	•
9.2.2	Explain 'flash gas'	U		•	•
9.2.3	Interpret signals from the bunker control system	I			•
9.2.4	Recognise the occurrence of 'flash gas'	K			•
9.2.5	Demonstrate correct and clear communication during bunkering process	A		•	•
9.2.6	Perform bunkering in failure mode	A			•
9.2.7	Describe the process sequences for bunkering operations	U			•
9.2.8	Explain the functionality of the control system (IAS) for the bunkering operations	U			•
9.2.9	Explain start- and stop sequences during bunker transfer	U			•
9.2.10	Explain the different processes following a 'blow-out' situation (overpressure relief) during bunkering	U			•
9.3	<i>Bunker calculations</i>				
9.3.1	Explain the difficulty of calculating quantity and quality of LNG bunkers	U		•	•
9.3.2	Explain the procedure for bunker quantity and quality calculations as defined by the company	U		•	•
9.3.3	Verify bunker quantity received	A		•	•
9.4	<i>Shore connections / emergency release</i>				
9.4.1	Explain the potential risk in connection with Emergency Release Couplings, immediately after release	U	•	•	•
9.4.2	Explain type and construction of shore connection arms (if applicable)	U		•	•
9.4.3	Interpret mooring requirements for a loading point			•	
9.4.4	Moor the vessel anticipating emergency release	A		•	
9.4.5	Explain the importance of emergency release or dry break couplings	U		•	•
9.4.6	Explain the use of flexible hoses	U		•	•
9.4.7	Explain Emergency Shutdown procedure between ship and shore			•	•
9.4.8	Explain emergency breakout operation of shore connection arms (if applicable)	U		•	•
9.4.9	Explain emergency breakout operation of flexible hoses	U		•	•
10	TANK CONDITIONING				
10.1	<i>Warming up</i>				
10.1.1	Describe the resources, infrastructure and local conditions required for warming up	U		•	•
10.1.2	Calculate the approximate duration of warming up	A		•	•
10.1.3	Perform warming up procedure, keeping the tank atmosphere in a non-explosive range at all times	A			•

Table 3-1 Competence requirements (Continued)

Column 1 shows the ID for the competence Column 2 is the defining activity for the competence Column 3 defines the level of competence required Column 4 indicates the applicability for Category A: Basic – all functions Column 5 indicates the applicability for Category B: Operational deck Column 6 indicates the applicability for Category C: Operational engine					
1	2	3	4	5	6
10.2	<i>Gas freeing</i>				
10.2.1	Describe principles and physics involved in the changing of tank atmospheres	U		•	•
10.2.2	Describe the resources, infrastructure and local conditions required for gas-freeing	U		•	•
10.2.3	Explain likely behaviour of vapour pressure during gas freeing	U		•	•
10.2.4	Calculate the approximate duration of gas-freeing	A			•
10.2.5	Perform gas-freeing, keeping the tank atmosphere in a non-explosive range at all times	A			•
10.3	<i>Inerting</i>				
10.3.1	Describe the principle of inerting	U	•	•	•
10.3.2	Explain possible problems related to inerting and causes, such as condensate formation	U		•	•
10.3.3	Describe dangers associated with incorrect inerting procedure	U		•	•
10.3.4	Make a plan for inerting tanks, pipelines and equipment	I			•
10.3.5	Determine when the inerting operation is completed based on parameters	A			•
10.3.6	Determine oxygen-content	A			•
10.3.7	Determine dew point	A			•
10.3.8	Perform a controlled change in tank atmosphere through inerting	A			•
10.4	<i>Purging</i>				
10.4.1	Explain principles of air purging	U		•	•
10.4.2	Demonstrate line up and procedures to purge tanks and pipelines	A			•
10.4.3	Perform air purging	A			•
10.4.4	Perform Nitrogen Purging	A			•
10.4.5	Determine when Nitrogen Purging operation is completed, based on parameters	A			•
11	WARM UP / HEATING				
11.1	<i>Water glycol intermediate circuit</i>				
11.1.1	Describe the water glycol intermediate circuit	U		•	•
11.1.2	Explain the alarms, interlocks and readings related to water glycol intermediate circuit	U			•
11.1.3	Set temperature control points of the water glycol intermediate circuit	A			•
11.1.4	Set flow distribution of the water glycol intermediate circuit	A			•
11.2	<i>Heating system</i>				
11.2.1	Recognise the link of the heating system with the engine cooling system	K		•	•
11.2.2	Describe 'overpressure protection' in relation to the heating system	U			•
12	CONTINGENCIES				
12.1	<i>General</i>				
12.1.1	Act in accordance with applicable contingency plan in case of an emergency	A	•	•	•
12.1.2	Determine a safe position on board in case of an LNG release, emergency discharge or spill	A	•	•	•
12.1.3	Determine the most suitable vessel position / vessel orientation considering environmental conditions in case of an LNG release or spill	I		•	

Table 3-1 Competence requirements (Continued)

Column 1 shows the ID for the competence Column 2 is the defining activity for the competence Column 3 defines the level of competence required Column 4 indicates the applicability for Category A: Basic – all functions Column 5 indicates the applicability for Category B: Operational deck Column 6 indicates the applicability for Category C: Operational engine					
1	2	3	4	5	6
12.2	LNG spills				
12.2.1	Explain the danger of cloud formation when LNG comes into contact with outside air and hot surfaces	U	•	•	•
12.2.2	Describe the actions required to mitigate spills	U	•	•	•
12.2.3	Demonstrate the proper way to handle an LNG-spill	A	•	•	•
12.2.4	Demonstrate directing a gas-cloud using the effect of waterspray	A	•	•	•
12.3	LNG leaks				
12.3.1	Recognise indications of a gas leak	K	•	•	•
12.3.2	Take appropriate action in case of a detected gas leak	A	•	•	•
12.3.3	Demonstrate the various methods to locate a gas leak	A			•
12.4	LNG fire				
12.4.1	Explain the potential danger of trying to extinguish a fire prior to stopping a leak	U	•	•	•
12.4.2	Recognise the heat intensity of burning LNG	U	•	•	•
12.4.3	State the extinguishing agents to be used on LNG	U	•	•	•
12.4.4	Demonstrate the proper way to control an LNG fire (flash, jet and poolfire)	A	•	•	•
12.5	Emergency shutdown				
12.5.1	Perform an emergency shutdown	A		•	•
12.6	Emergency unloading/ transfer of LNG				
12.6.1	Describe the possibilities for emergency unloading or transfer of LNG	U		•	•
12.6.2	Perform the procedure for transferring LNG to another vessel in case of an emergency	A		•	•
12.7	Emergency discharge / release				
12.7.1	List principles of emergency discharge	K		•	•
12.7.2	Explain the procedure and points of attention related to an emergency release of LNG	U		•	•
12.7.3	Outweigh the consequences of igniting LNG or LNG release	I		•	•
12.8	Emergency separation				
12.8.1	Describe criteria / situations which would trigger emergency separation	U		•	•
12.8.2	Find the local port requirements on emergency separation	A		•	•
12.8.3	Explain the steps involved in emergency separation during bunkering	U		•	•



SECTION 4 USE OF THE STANDARD

This standard can be used in the following ways:

- As a reference to familiarise crew or assess crew.
- As a reference for global competence and training requirements.
- As a guide to training providers, who are to develop courses according to the requirements of the standard and needs of the industry.
- As a reference document for e.g. certification of personnel.

The standard follows the category-structure of the Interim Guidelines on Safety for Natural Gas-Fuelled Engine Installations in Ships. This category structure has been the basis for current training programs.

SECTION 5 REFERENCES

- The Society of International Gas Tanker and Terminal Operators (SIGTTO) - LNG shipping suggested competency standards.
- DNV GL standard DNV GL-ST-0010 – *Competence of shipboard LNG cargo operators*.
- Resolution MSC. 285(86) - *Interim guidelines on safety for natural gas-fuelled engine installations in ships*.
- Various sources and technical documentation.

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CHANGES – HISTORIC

Note that historic changes older than the editions shown below have not been included. Older historic changes (if any) may be retrieved through <http://www.dnvgl.com>.

April 2013 edition

Main changes

This is a new document.



DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16 000 professionals are dedicated to helping our customers make the world safer, smarter and greener.