LNG Shipping Suggested Competency Standards

Guidance and suggested best practice for the LNG industry in the 21st century

First Edition November 2005

SIGTTO

Notice of Terms of Use

While any advice given in this document has been developed using the best information currently available to the Society of International Gas Tanker and Terminal Operators Ltd (SIGTTO) as received from its membership, it is intended purely as guidance to be used at the user's own risk. No responsibility is accepted by SIGTTO, or any officer, director, employee, representative or the membership of SIGTTO, or by any person, firm, corporation or organisation who, or which, has been in any way concerned with the furnishing of information or data, the compilation or any translation, publishing, supply or sale of the document for the accuracy of any information or advice given in the document or any omission from the document or for any consequence whatsoever resulting directly or indirectly from the compliance with or adoption of in whole or in part any guidance contained in the document even if caused by a failure to exercise reasonable care.

UNIT E_ELECT_3 CONTROL, MAINTAIN AND REPAIR ELECTRICAL PLANT, CONTROL AND INSTRUMENTATION SYSTEMS

Outcomes of effective performance – what you must do

1. Plan and liaise with relevant people to identify and confirm the requirements and the implications of maintenance and repair with regard to vessel operation
2. Confirm that work areas, machinery and equipment are safe for work to proceed and comply with legislative requirements, codes of practice, isolation and earthing procedures, permit to work procedures and environmental concerns
3. Carry out the planned maintenance, checks and tests in accordance with established safety rules and regulations, manufacturers instructions and recognised practice
4. Maintain the integrity of electrical equipment in hazardous areas
5. Identify variances from the electrical, control and instrumentation systems specification and non-standard operating conditions and take the appropriate remedial action in a timely and safe manner.
6. Restore the equipment or system to the correct settings and specification using the appropriate repair or adjustment method
7. Carry out the de-isolation procedures to vessel standards, operational requirements and specification
8. Carry out tests to verify that equipment and systems meet required performance after maintenance or repair
9. Provide accurate and complete records

Knowledge and understanding – what you must know

a. The regulations and guidelines related to the maintenance of electrical and control systems
b. The safe isolation and earthing procedures applicable to the systems, including the permit to work and isolation systems
c. The types of electrical equipment which may be used in hazardous areas, and the operation and maintenance requirements
d. Operational parameters, specifications, limits and maintenance requirements for electrical and control systems and equipment
e. What constitutes a fault condition and the remedial action that may be required when such conditions are encountered
f. The testing, adjustment and repair methods applicable to electrical and control systems and equipment
g. Record keeping requirements

INTRODUCTION

The Liquefied Natural Gas (LNG) shipping industry has an exceptional safety record. This is a record the industry can be very proud of.

LNG shipping, at the beginning of the 21st century, is experiencing a period of expansion and change unlike anything the industry has seen in the past.

This expansion is to be welcomed, however, it will also bring with it many issues and challenges to which the industry will have to respond or pre-empt in order to maintain its excellent safety record and ensure that the public has confidence in the transportation of LNG by sea.

One of the biggest issues will be in respect of how to ensure that shortages of seagoing personnel, with experience of LNG ships, do not affect the ability to effectively man the expanding LNG fleet. In this respect, at present there is an absence of industry accepted operational training standards specifically for officers serving on LNG vessels. Therefore, with a view to maintaining the quality of such officers, SIGTTO developed these LNG Operational Standards for officers with the intention of their being adopted as the industry's default best practice standard. The standards are not considered to be incapable of improvement and SIGTTO encourages individual operators to consider any additional or more appropriate standards that may be suitable, to their specific operations, ships or trades.

The project commenced in early 2005 with the first of a series of working groups utilising the experience within the SIGTTO membership. The standards were approved by the SIGTTO board in November 2005.

These standards have been written using the "competence based methodology" which is used in STCW and widely throughout industry in general.

They are offered by SIGTTO as guidance to the industry and, as such, their adoption and implementation cannot be, and is not, mandatory.

However, the standards are produced after consultation within the industry and are intended to represent the default best practice operational training standard for officers serving onboard LNG vessels.

They also apply to the specific rank, if carried. For example some LNG vessels do not carry electricians or cargo engineers.

HOW TO USE THESE STANDARDS

The main section of the standards contains the functions for all eight ranks addressed. These functions outline what tasks and knowledge are suggested to be necessary to satisfactorily perform in a particular rank.

The summary for each function describes what each unit is about and who it is intended for. The outcomes of effective performance describes what it is suggested the officer should be able to do and the knowledge and understanding describes what it is suggested that the officer should know.

Some ranks have more involved functions than others, the senior officers, understandably, being more onerous than the junior officers. The functions are subtitled D (Deck) or E (engine). The cargo engineer has been placed under Deck.

The knowledge and understanding listed in each function has been broken down into detailed underpinning knowledge in the attached appendix. There is a table at the end of each function which references which part of the appendix applies to which function knowledge statement. For example; Master function one knowledge statement a (D_MAST_1a) *The properties and characteristics of*

liquefied and other relevant gases has all of appendix 1.1 referenced to it. Therefore the master should have all of the knowledge contained in this section.

There is also a cross reference in the under pinning knowledge appendix which indicates which ranks and which knowledge statements apply to a particular section of the appendix. This cross reference is found in the eight columns of ranks on the right hand side of the page.

For example it can be seen that appendix 1.1.2 *Know and understand the 'Gas Laws' and how they are applicable to LNG operations- Explain pressure and temperature relationship* applies to the Master function one knowledge statement a. Additionally it also applies to the chief officer, cargo engineer, chief engineer and second engineer for knowledge statement a.

In parts of the appendix can be seen a "higher level" and a "lower level" statement for an item of knowledge, the higher level generally only applies to the senior ranks while the lower level generally applies to all ranks. For example appendix item 2.1.1 is *Have an awareness of the Moss type*, while appendix item 2.1.2 *is Know and understand the Moss Type.* By reference to the columns of the eight ranks, the higher level statement 2.1.2 can be seen to apply to the master, chief officer, cargo engineer and chief engineer only while 2.1.1 applies to all ranks.

The columns which are shaded out indicates that this part of the appendix does not apply to the rank.

An asterix in the title of an under pinning knowledge statement indicates there is a reference applicable to this knowledge. For example 1.8 risk assessment is referenced to the Code of Safe Working Practices where Chapter one applies. This publication indicates the level of knowledge required as per the detail of section 1.8.

SIGTTO LNG Training Project – Standards for all ranks

Contents

		Page No
Master		7
1	Familiarisation	
2	Safety Equipment	
3	Plan normal cargo cycle	
4	Monitor cargo ops	
5	Non-Standard cargo ops	
6	Emergency cargo ops	
7	Integrity of cargo spaces and equipment	
8	Commercial awareness of LNG operations	
Chief Officer		32
1	Familiarisation	
2	Safety Equipment	
3	Plan normal cargo cycle	
4	Monitor cargo ops	
5	Non-Standard cargo ops	
6	Emergency cargo ops	
7	Integrity of cargo spaces and equipment	
2nd Off / 3rd Off		54
1	Familiarisation	
2	Safety Equipment	
3	Monitor cargo ops	
Cargo Eng		64
1	Familiarisation	
2	Safety Equipment	
3	Monitor cargo ops	
4	Non-Standard/Emergency cargo ops	
5	Integrity of cargo spaces and equipment	
Chief Eng		80
1	Familiarisation	
2	Safety Equipment	
3	Normal cargo cycle	
4	Non-Standard cargo ops	

ELECTRICAN

UNIT E_ELECT_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Unit summary

What this unit is about

This unit defines the competence required to develop familiarisation and understanding of LNG transportation requirements.

The properties of liquefied and other relevant gases and their impact on safety and vessel operations are identified and determined.

The regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment are identified and their impact on cargo storage, transportation and containment is determined.

The complete cargo cycle is identified, and the cargo equipment required for each cargo cycle stage is identified including any specific features and issues which may arise in operation.

Individual responsibilities and the specific vessel and cargo operations risk assessment requirements and processes are confirmed.

Who this unit is for

This unit is for Electrical Engineers on board Liquefied Natural Gas Carriers.

UNIT E_ELECT_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Outcomes of effective performance – what you must do:

1. Identify the properties and characteristics of liquefied and other relevant gases and determine their impact on safety and vessel operations
2. Identify the regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment and determine the impact on cargo storage, transportation and containment
3. Determine specific loading and discharging features and cargo cycles and confirm individual responsibilities for those involved
4. Identify the ship to shore interface and equipment and determine any issues they might raise during vessel and cargo operations
5. Confirm the specific vessel and cargo operations risk assessment requirements and processes for those involved

Knowledge and understanding – what you must know

a. The properties and characteristics of liquefied and other relevant gases
b. Personnel safety, vessel safety and environmental considerations related to the carriage of LNG
c. The regulations and guidelines related to the carriage of LNG at sea
d. The features of LNG ship design and safety systems, how and why they differ from other typical ship design and safety features and the differences they make to ship operations, ship handling and cargo storage
e. LNG propulsion system types, typical operating parameters and specific features and how they relate to the method of cargo management
f. The materials used on LNG ships, where they are used and why they are suitable for their purpose
g. Cargo tank filling capacities, limitations and associated features
h. Specific features and commercial implications, including vetting and other inspections, associated with LNG storage, containment, measurement, loading, discharging and cargo cycles
i. How different types of ship to shore interface processes and equipment might impact on vessel, mooring and cargo operations
j. Safe and efficient LNG ballast-handling practices
k. LNG-specific risk assessment requirements and processes
l. Individual areas of responsibility

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_ELECT_1a	1.1.1
E_ELECT_1b	1.4, 1.6.1, 1.6.3, 1.7.1
E_ELECT_1c	1.3.1, 1.3.3
E_ELECT_1d	1.2.1, 2.1.1, 2.1.3, 3.12.1, 5.1 (All)
E_ELECT_1e	3.16.1
E_ELECT_1f	1.5.1
E_ELECT_1g	3.10.1
E_ELECT_1h	3.11.1, 3.11.3, 6.2.1
E_ELECT_1i	3.5.1, 4.5.4
E_ELECT_1j	4.8.3, 4.10.4
E_ELECT_1k	1.8.1
E_ELECT_1l	1.9.1

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_MAST_1a	1.1 (All)
D_MAST_1b	1.4, 1.6 (All), 1.7 (All)
D_MAST_1c	1.3 (All), 6.1.6
D_MAST_1d	1.2 (All), 2.1 (All), 3.12.1, 5.1 (All)
D_MAST_1e	3.16.1
D_MAST_1f	1.5 (All)
D_MAST_1g	3.10 (All)
D_MAST_1h	3.11 (All), 6.1 (All), 6.2 (All)
D_MAST_1i	3.5 (All), 3.6, 4.5 (All), 6.3
D_MAST_1j	4.8.3, 4.10.4
D_MAST_1k	1.8 (All)
D_MAST_1l	1.9 (All)

UNIT D_MAST_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Unit summary

What this unit is about

This unit defines the competence required to manage the operation, testing and inspection of safety systems and equipment on board Liquefied Natural Gas Carriers.

The equipment parameters are identified, along with maintenance and testing requirements. The individual responsibilities for equipment are confirmed, safety systems and equipment are managed and operated as required in line with regulations, procedures, guidelines and safety practice and records are kept.

The systems and equipment covered by this unit include, but is not limited to the following systems and specific features:

- Emergency shut down system
  - Ship/shore link
  - Fusible plugs/sensors
  - Cargo machinery space flooding system activation
  - Emergency release system
- Water curtain and deck spray
  - Rinsing/testing etc
- Gas detection systems – fixed and portable
  - Proof of functionality
- Fixed dry powder

Who this unit is for

This unit is for Masters on board Liquefied Natural Gas Carriers.

UNIT D_MAST_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Outcomes of effective performance – what you must do

1. Identify the safety systems and equipment required for carriage of LNG, its parameters, operating specifications and limits and maintenance requirements.
2. Confirm that the status of the safety systems and equipment meets operating parameters and requirements.
3. Confirm appropriate monitoring systems and required tests for safety systems and equipment
4. Confirm individual responsibilities for maintaining, testing and inspecting safety systems and equipment
5. Verify the results of maintenance, testing and inspection of safety systems and equipment and where they are not in line with required parameters, determine the relevant action and/or inform the appropriate person.
6. Operate safety systems and equipment as required in line with regulations, procedures, guidelines and safety practice
7. Provide accurate and complete records.

Knowledge and understanding – what you must know

a. Operational parameters, specifications, limits and maintenance requirements for LNG safety systems and equipment
b. Monitoring systems, requirements and tests for safety systems and equipment
c. Individual areas of responsibility
d. The actions to take with non-compliance of safety systems and equipment and who needs to be informed
e. How to operate safety systems and equipment, and the related regulations, procedures, guidelines and safety practice
f. Record keeping requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_MAST_2a	3.5 (All), 3.6, 3.7, 3.8 (All), 3.9(All)
D_MAST_2b	3.3 (All), 3.4 (All), 3.14 (All)
D_MAST_2c	1.9 (All)
D_MAST_2d	1.9.1
D_MAST_2e	1.3 (All), 3.8.1, 3.9.1
D_MAST_2f	1.11 (All)

UNIT E_JENG_3 OPERATE GAS-BURNING EQUIPMENT AND ASSOCIATED SYSTEMS

*Outcomes of effective performance – **what you must do***

1. Operate fuel gas combustion equipment and machinery within safe operating limits and defined parameters.
2. Identify non-standard operating conditions from alarms and other relevant sources and inform the appropriate person in a timely and safe manner.
3. Make adjustments to the plant according to instructions received, to maintain specified voyage arrival and loading / delivery cargo conditions.
4. Assist with maintenance and testing, within relevant time scales, in accordance with organisational procedures.

Knowledge and understanding – what you must know

a. Types, design and safe operation of fuel gas combustion equipment and machinery, typical plant parameters and limitations and how they will affect operations.

b. What constitutes a fault condition and the importance of informing the appropriate person.

c. Maintenance and testing requirements.

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_JENG_3a	3.17.1, 3.17.2, 3.17.3, 3.17.5
E_JENG_3b	1.9.1
E_JENG_3c	3.17.6

UNIT E_JENG_4 ASSIST WITH THE OPERATION OF THE PROPULSION PLANT UNDER NON-STANDARD CONDITIONS

Unit Summary

What this unit is about

This unit defines the competence required to work as part of a team to assist with the operation of the propulsion plant on Liquefied Natural Gas Carriers under non-standard conditions.

The type, nature and scale of the non-standard condition is determined, the options for dealing with the condition are evaluated, risk assessments are carried out and a plan to deal with the situation formed.

Accurate and clear instructions are given to put the determined plan into operation. The effects of the plan are monitored and adjustments made as required. The plan is subsequently reviewed to identify lessons learnt and provide feedback.

The non-standard conditions covered by this unit include, but are not limited to, the following situations:

- Manual firing
- Loss of Nitrogen gas supply
- Loss of fuel gas pressure
- Leaks within gas hoods or ducts
- Inability to operate the steam dump facility
- Loss of LD gas compressors, heaters, vaporisers etc
- Key equipment not available

Who this unit is for

This unit is for Third and Fourth Engineers on board Liquefied Natural Gas Carriers.

UNIT E_JENG_4 ASSIST WITH THE OPERATION OF THE PROPULSION PLANT UNDER NON-STANDARD CONDITIONS

Outcomes of effective performance – what you must do

1. Determine the type, nature and scale of the condition from alarms and relevant sources.
2. Identify the implications of the non-standard condition and inform the relevant personnel.
3. Assist in the remedial operation and carry out adjustments according to the instructions received and report status to the relevant personnel.

Knowledge and understanding – what you must know

a. Types of non-standard conditions and safe practice for dealing with them.

b. Individual levels of responsibility and the importance of checking and confirming understanding of instructions given

UNIT D_MAST_4 MONITOR AND REVIEW CARGO CYCLE OPERATIONS

Outcomes of effective performance – you must be able to do the following:

1. Confirm cargo operation details and clarify operational aspects where required to ensure effective and appropriate monitoring activities
2. Carry out and monitor checks at relevant times and critical points, and instruct others as required, to confirm correct and appropriate implementation of the operational plan
3. Identify appropriate changes to the plan where its execution shows shortfalls or problems or raises issues during implementation
4. Take appropriate action to deal with any problems that arise during implementation in line with safety and organisational requirements
5. Instruct others as required and implement identified changes in line with applicable regulations, procedures, guidelines and safety practice
6. Review the operation with relevant personnel and evaluate the potential for safer and more efficient improvements and adaptations
7. Provide feedback to relevant personnel and record appropriate information about the monitoring activity and outcomes of the review in line with organisational requirements

Knowledge and understanding – what you must know

a. What the cargo plan covers and safety and organisational monitoring and review requirements for cargo cycle operations
b. Specific checks required for each operation and their frequency
c. Typical and specific changes that might need to be made to the plan and it's impact on cargo cycle operations
d. The types of problems that may arise and the actions to take to deal with them safely
e. Organisational regulations, procedures, guidelines, recording and safety practice for implementing changes to the plan
f. The roles and numbers of personnel involved in monitoring and review activities

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_MAST_4a D_MAST_4b D_MAST_4c	4 (All)
D_MAST_4d	2.2.3, 2.3.3, 2.4.5, 2.5.4, 2.6.4, 2.7.4, 2.8.4, 2.9.4, 2.10.4, 2.11.4, 2.12.3, 2.13.3, 2.14.3, 2.15.3, 3.1.3, 3.2.3, 3.3.3, 3.4.3, 5.7 (All)
D_MAST_4e	1.3 (All), 1.11 (All), 1.12
D_MAST_4f	1.9 (All)

UNIT D_MAST_5 PLAN FOR AND MANAGE CARGO OPERATIONS UNDER NON-STANDARD CONDITIONS

Unit Summary

What this unit is about

This unit defines the competence required to ensure the effectiveness of cargo operations on Liquefied Natural Gas Carriers under non-standard conditions.

The type, nature and scale of the non-standard condition is determined, the options for dealing with the condition are evaluated, risk assessments are carried out and a plan to deal with the situation formulated in conjunction with other senior officers and superintendents.

Accurate and clear instructions are given to put the determined plan into operation. The effects of the plan are monitored and adjustments made as required. The plan is subsequently reviewed to identify lessons learnt and provide feedback.

The non-standard conditions covered by this unit include, but are not limited to, the following situations:

- Pressurised discharge
- Use of emergency discharge pump
- Single tank gas free
- Ship to Ship Transfer
- Partial loading
- Key equipment not available
- Loss of gas burning capability
- Prolonged loss of power to cargo and ancillary systems

Who this unit is for

This unit is for Masters on board Liquefied Natural Gas Carriers.

UNIT D_MAST_5 PLAN FOR AND MANAGE CARGO OPERATIONS UNDER NON-STANDARD CONDITIONS

Outcomes of effective performance – what you must do

1. Determine the type, nature and scale of the condition from alarms and relevant sources
2. Identify the options for how to deal safely and in a controlled manner with the condition
3. Carry out risk assessments and planning for each option and determine the most appropriate plan and course of action to deal with the situation
4. Provide accurate and clear instructions and information to relevant people to carry out the plan
5. Put the determined plan into operation in a timely and safe manner
6. Monitor the effects of the plan as required, identify and make appropriate adjustments
7. Review the plan and operational procedures at the appropriate time and identify lessons learnt and provide feedback to relevant people

Knowledge and understanding – what you must know

a. Types of non-standard conditions and applicable regulations, procedures, guidelines and safety practice for dealing with them
b. How to carry out risk assessments
c. How to formulate, adjust and implement contingency plans
d. Individual levels of responsibility and the importance of checking and confirming understanding of instructions given
e. The importance of reviewing the plan and course of action taken

3rd/4th ENG

UNIT E_JENG_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Unit summary

What this unit is about

This unit defines the competence required to develop familiarisation and understanding of LNG transportation requirements.

The properties of liquefied and other relevant gases and their impact on safety and vessel operations are identified and determined.

The regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment are identified and their impact on cargo storage, transportation and containment is determined.

The complete cargo cycle is identified, and the cargo equipment required for each cargo cycle stage is identified including any specific features and issues which may arise in operation.

Individual responsibilities and the specific vessel and cargo operations risk assessment requirements and processes are confirmed.

Who this unit is for

This unit is for Third and Fourth Engineers on board Liquefied Natural Gas Carriers.

UNIT E_JENG_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Outcomes of effective performance – what you must do:

1. Identify the properties and characteristics of liquefied and other relevant gases and determine their impact on safety and vessel operations
2. Identify the regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment and determine the impact on cargo storage, transportation and containment
3. Determine specific loading and discharging features and cargo cycles and confirm individual responsibilities for those involved
4. Identify the ship to shore interface and equipment and determine any issues they might raise during vessel and cargo operations
5. Confirm the specific vessel and cargo operations risk assessment requirements and processes for those involved

Knowledge and understanding – what you must know

a. The properties and characteristics of liquefied and other relevant gases
b. Personnel safety, vessel safety and environmental considerations related to the carriage of LNG
c. The regulations and guidelines related to the carriage of LNG at sea
d. The features of LNG ship design and safety systems, how and why they differ from other typical ship design and safety features and the differences they make to ship operations, ship handling and cargo storage
e. LNG propulsion system types, typical operating parameters and specific features and how they relate to the method of cargo management
f. The materials used on LNG ships, where they are used and why they are suitable for their purpose
g. Cargo tank filling capacities, limitations and associated features
h. Specific features and commercial implications, including vetting and other inspections, associated with LNG storage, containment, measurement, loading, discharging and cargo cycles
i. How different types of ship to shore interface processes and equipment might impact on vessel, mooring and cargo operations
j. Safe and efficient LNG ballast-handling practices
k. LNG-specific risk assessment requirements and processes
l. Individual areas of responsibility

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_JENG_1a	1.1.1, 1.1.3
E_JENG_1b	1.4, 1.6.1, 1.6.3, 1.7.1
E_JENG_1c	1.3.1, 1.3.3
E_JENG_1d	1.2.1, 2.1.1, 2.1.3, 3.12.1, 5.1 (All)
E_JENG_1e	3.16.1, 3.17.1, 3.17.2, 3.17.3, 3.17.5
E_JENG_1f	1.5.1
E_JENG_1g	3.10.1
E_JENG_1h	3.11.1, 6.2.1
E_JENG_1i	3.5.1, 4.5.4
E_JENG_1j	4.8.3, 4.10.4
E_JENG_1k	1.8.1
E_JENG_1l	1.9.1

UNIT D_MAST_7 ENSURE THE INTEGRITY OF CARGO CONTAINMENT, CARGO EQUIPMENT AND CARGO RELATED SPACES

Unit Summary

What this unit is about

This unit defines the competence required to ensure the integrity of the cargo containment, cargo equipment and cargo related spaces.

The parameters and requirements for each item of cargo equipment and spaces are identified. Equipment operation, maintenance, testing and inspection requirements are identified and verified. Individual responsibilities are identified, and rectifying actions are implemented in the event of problems arising. Accurate and complete records are maintained.

The systems, equipment and spaces covered by this unit include, but are not limited to, the following systems, their components and specific features:

- Air and IG driers
- IG Generator
- N2 generator
- Vaporiser
- HD compressor
- LD compressor
- Gas Heater
- Forcing vaporiser
- Cargo pumps
- Spray pumps
- Cargo tank protection devices
- Cargo line protection devices
- N2 pressurisation and purge
- Cofferdam heating system
- Level gauging system
- Custody Transfer System
- Pneumatic/Hydraulic valve operation
- Emergency discharge pump
- Instrumentation and control systems
- Reliquifaction plant (where applicable)
- Oxidiser (where applicable)
- Regassification plant (Where applicable)
- Cargo tanks
- Hold spaces
- Ballast tanks

Who this unit is for

This unit is for Masters on board Liquefied Natural Gas Carriers.

UNIT D_MAST_7 ENSURE THE INTEGRITY OF CARGO CONTAINMENT, CARGO EQUIPMENT AND CARGO RELATED SPACES

Outcomes of effective performance – what you must do

1. Identify cargo containment operational parameters.
2. Identify the equipment required for cargo operations, its parameters, operating specifications and limits and maintenance requirements.
3. Confirm status of the equipment meets operating parameters and requirements.
4. Identify the function and conditions of cargo related spaces.
5. Confirm appropriate monitoring systems and required tests for cargo containment, cargo equipment and cargo related spaces.
6. Confirm individual responsibilities for maintaining, testing and inspecting cargo containment, cargo equipment and cargo related spaces.
7. Determine an appropriate course of action where problems and issues with effectiveness of the maintenance, testing and inspection are identified and inform the relevant personnel
8. Provide accurate and complete records.

Knowledge and understanding – what you must know

a. Operational parameters for cargo containment
b. Operational parameters, specifications, limits and maintenance requirements for cargo operations equipment
c. Types of cargo related spaces, the functions they serve and what constitutes an appropriate condition for optimum effect
d. Maintenance, tests and inspections required for cargo containment, equipment, monitoring systems and cargo related spaces
e. Individual areas of responsibility
f. Types of problems and issues that may arise, rectifying actions and who needs to be informed
g. Record keeping requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_MAST_7a	2.1 (All)
D_MAST_7b	2.2 (All), 2.3 (All), 2.4 (All), 2.5 (All), 2.6 (All), 2.7 (All), 2.8 (All), 2.9 (All), 2.10 (All), 2.11 (All), 2.12 (All), 2.13 (All), 2.14 (All), 2.15 (All), 2.16 (All), 2.17, 2.18, 2.19, 3.1 (All), 3.2 (All), 3.3.1, 3.3.2, 3.4.1, 3.5 (All), 3.10 (All), 3.11.1, 3.11.2, 3.12.1, 3.14.1
D_MAST_7c	2.20 (All)
D_MAST_7d	3.3.4, 3.4.2, 3.5.7, 3.11.3
D_MAST_7e	1.9 (All)
D_MAST_7f	2.2.3, 2.3.3, 2.4.5, 2.5.4, 2.6.4, 2.7.4, 2.8.4, 2.9.4, 2.10.4, 2.11.4, 2.12.3, 2.13.3, 2.14.3, 2.15.3, 3.1.3, 3.2.3, 3.3.3, 3.4.3
D_MAST_7g	1.11 (All)

UNIT D_MAST_8 DEVELOP AN AWARENESS OF THE COMMERCIAL ASPECTS OF LNG TRANSPORTATION

Unit Summary

What this unit is about

This unit defines the competence required to develop an awareness of the commercial aspects of LNG transportation.

The basic terms and conditions for buying, selling and transporting LNG are identified, and their implications for vessel operations are recognised.

Who this unit is for

This unit is for masters on board Liquefied Natural Gas Carriers.

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_2ENG_4a E_2ENG_4b E_2ENG_4d E_2ENG_4e	1.11.2, 2.18, 3.17 (All)
E_2ENG_4c	2.7 (All), 2.8 (All), 2.9.1
E_2ENG_4f	1.3 (All)

UNIT E_2ENG_5 CONTROL OPERATION OF THE PROPULSION PLANT UNDER NON-STANDARD CONDITIONS

Unit Summary

What this unit is about

This unit defines the competence required to control the operation of the propulsion plant on Liquefied Natural Gas Carriers under non-standard conditions.

The type, nature and scale of the non-standard condition is determined, the options for dealing with the condition are evaluated, risk assessments are carried out and a plan to deal with the situation formed.

Accurate and clear instructions are given to put the determined plan into operation. The effects of the plan are monitored and adjustments made as required. The plan is subsequently reviewed to identify lessons learnt and provide feedback.

The non-standard conditions covered by this unit include, but are not limited to, the following situations:

- Manual firing
- Loss of Nitrogen gas supply
- Loss of fuel gas pressure
- Leaks within gas hoods or ducts
- Inability to operate the steam dump facility
- Loss of LD gas compressors, heaters, vaporisers etc
- Key equipment not available

Who this unit is for

This unit is for Second Engineers on board Liquefied Natural Gas Carriers.

UNIT E_2ENG_5 CONTROL OPERATION OF THE PROPULSION PLANT UNDER NON-STANDARD CONDITIONS

Outcomes of effective performance – what you must do

1. Determine the type, nature and scale of the condition from alarms and relevant sources
2. Identify the options for how to deal safely and in a controlled manner with the condition
3. Carry out risk assessments and planning for each option and determine the most appropriate plan/course of action to deal with the situation
4. Provide accurate and clear instructions and information to relevant people to carry out the plan
5. Put the determined plan into operation in a timely and safe manner
6. Monitor the effects of the plan as required, identify and make adjustments according to the effect on the condition
7. Review the plan and operational procedures at the appropriate time and identify lessons learnt and provide feedback to relevant people and organisations.

Knowledge and understanding – what you must know

a. Types of non-standard conditions and applicable regulations, procedures, guidelines and safety practice for dealing with them
b. How to carry out risk assessments
c. How to formulate, adjust and implement contingency plans
d. Individual levels of responsibility and the importance of checking and confirming understanding of instructions given
e. The importance of reviewing the plan and course of action taken

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_2ENG_5a	1.3.1, 1.3.2, 5.7
E_2ENG_5b	1.8 (All)
E_2ENG_5c	1.10 (All)
E_2ENG_5d	1.9 (All)
E_2ENG_5e	1.12 (All)

UNIT D_COFF_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Outcomes of effective performance - You must be able to do the following:

1. Identify the properties and characteristics of liquefied and other relevant gases and determine their impact on safety and vessel operations
2. Identify the regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment and determine the impact on cargo storage, transportation and containment
3. Determine specific loading and discharging features and cargo cycles and confirm individual responsibilities for those involved
4. Identify the ship to shore interface and equipment and determine any issues they might raise during vessel and cargo operations
5. Confirm the specific vessel and cargo operations risk assessment requirements and processes for those involved

Knowledge and understanding – what you must know

a. The properties and characteristics of liquefied and other relevant gases
b. Personnel safety, vessel safety and environmental considerations related to the carriage of LNG
c. The regulations and guidelines related to the carriage of LNG at sea
d. The features of LNG ship design and safety systems, how and why they differ from other typical ship design and safety features and the differences they make to ship operations, ship handling and cargo storage
e. LNG propulsion system types, typical operating parameters and specific features and how they relate to the method of cargo management
f. The materials used on LNG ships, where they are used and why they are suitable for their purpose
g. Cargo tank filling capacities, limitations and associated features
h. Specific features and commercial implications, including vetting and other inspections, associated with LNG storage, containment, measurement, loading, discharging and cargo cycles
i. How different types of ship to shore interface processes and equipment might impact on vessel, mooring and cargo operations
j. Safe and efficient LNG ballast-handling practices
k. LNG-specific risk assessment requirements and processes
l. Individual areas of responsibility

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_COFF_1a	1.1 (All)
D_COFF_1b	1.4, 1.6 (All), 1.7 (All)
D_COFF_1c	1.3 (All), 6.1.6
D_COFF_1d	1.2 (All), 2.1 (All), 3.12.1, 5.1 (All)
D_COFF_1e	3.16.1
D_COFF_1f	1.5 (All)
D_COFF_1g	3.10 (All)
D_COFF_1h	3.11 (All), 6.1 (All), 6.2 (All)
D_COFF_1i	3.5 (All), 3.6, 4.5 (All)
D_COFF_1j	4.8.3, 4.10.4
D_COFF_1k	1.8 (All)
D_COFF_1l	1.9 (All)

UNIT D_COFF_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Unit summary

What this unit is about

This unit defines the competence required to manage the operation, testing and inspection of safety systems and equipment on board Liquefied Natural Gas Carriers.

The equipment parameters are identified, along with maintenance and testing requirements. The individual responsibilities for equipment are confirmed, safety systems and equipment are managed and operated as required in line with regulations, procedures, guidelines and safety practice and records are kept.

The systems and equipment covered by this unit include, but is not limited to the following systems and specific features:

- Emergency shut down system
  - Ship/shore link
  - Fusible plugs/sensors
  - Cargo machinery space flooding system activation
  - Emergency release system
- Water curtain and deck spray
  - Rinsing/testing etc
- Gas detection systems – fixed and portable
  - Proof of functionality
- Fixed dry powder

Who this unit is for

This unit is for Chief Officers on board Liquefied Natural Gas Carriers.

UNIT D_COFF_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Outcomes of effective performance – what you must do

1. Identify the safety systems and equipment required for carriage of LNG, its parameters, operating specifications and limits and maintenance requirements.
2. Confirm that the status of the safety systems and equipment meets operating parameters and requirements.
3. Confirm appropriate monitoring systems and required tests for safety systems and equipment
4. Confirm individual responsibilities for maintaining, testing and inspecting safety systems and equipment
5. Verify the results of maintenance, testing and inspection of safety systems and equipment and where they are not in line with required parameters, determine the relevant action and/or inform the appropriate person.
6. Operate safety systems and equipment as required in line with regulations, procedures, guidelines and safety practice
7. Provide accurate and complete records.

Knowledge and understanding – what you must know

a. Operational parameters, specifications, limits and maintenance requirements for LNG safety systems and equipment
b. Monitoring systems, requirements and tests for safety systems and equipment
c. Individual areas of responsibility
d. The actions to take with non-compliance of safety systems and equipment and who needs to be informed
e. How to operate safety systems and equipment, and the related regulations, procedures, guidelines and safety practice
f. Record keeping requirements

UNIT E_2ENG_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Unit summary

What this unit is about

This unit defines the competence required to manage the operation, testing and inspection of safety systems and equipment on board Liquefied Natural Gas Carriers.

The equipment parameters are identified, along with maintenance and testing requirements. The individual responsibilities for equipment are confirmed, safety systems and equipment are managed and operated as required in line with regulations, procedures, guidelines and safety practice and records are kept.

The systems and equipment covered by this unit include, but are not limited to the following systems and specific features:

- Emergency shut down system
  - Ship/shore link
  - Fusible plugs/sensors
  - Cargo machinery space flooding system activation
  - Emergency release system
- Water curtain and deck spray
  - Rinsing/testing etc
- Gas detection systems – fixed and portable
  - Proof of functionality
- Fixed dry powder

Who this unit is for

This unit is for Second Engineers on board Liquefied Natural Gas Carriers.

Outcomes of effective performance – what you must do

1. Identify the safety systems and equipment required for carriage of LNG, its parameters, operating specifications and limits and maintenance requirements.
2. Confirm that the status of the safety systems and equipment meets operating parameters and requirements.
3. Confirm appropriate monitoring systems and required tests for safety systems and equipment
4. Confirm individual responsibilities for maintaining, testing and inspecting safety systems and equipment
5. Verify the results of maintenance, testing and inspection of safety systems and equipment and where they are not in line with required parameters, determine the relevant action and/or inform the appropriate person.
6. Operate safety systems and equipment as required in line with regulations, procedures, guidelines and safety practice
7. Provide accurate and complete records.

Knowledge and understanding – what you must know

a. Operational parameters, specifications, limits and maintenance requirements for LNG safety systems and equipment
b. Monitoring systems, requirements and tests for safety systems and equipment
c. Individual areas of responsibility
d. The actions to take with non-compliance of safety systems and equipment and who needs to be informed
e. How to operate safety systems and equipment, and the related regulations, procedures, guidelines and safety practice
f. Record keeping requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_2ENG_2a	3.5.1, 3.5.2, 3.5.4, 3.5.5, 3.6, 3.7, 3.8 (All), 3.9.1
E_2ENG_2b	3.3 (All), 3.4 (All), 3.14 (All)
E_2ENG_2c	1.9 (All)
E_2ENG_2d	1.9.1
E_2ENG_2e	1.3 (All)
E_2ENG_2f	1.11 (All)

UNIT E_2ENG_3 ENSURE EFFECTIVENESS OF THE ENTIRE CARGO CYCLE

Unit Summary

What this unit is about

This unit defines the competence required to ensure the effectiveness of the entire cargo cycle and the systems and equipment required for cargo cycle operations.

The parameters and requirements for each stage of the cargo cycle are identified. Equipment operation, maintenance, testing and inspection requirements are identified and verified. Individual responsibilities are identified, and rectifying actions are implemented in the event of problems arising. Accurate and complete records are maintained.

The entire cargo cycle from refit to refit is covered, and includes the following cargo cycle stages:

- Cleaning
- Drying
- Inerting
- Purging/gassing up
- Cool down
- Loading
- Loaded passage
- Discharge including heel out
- Ballast passage
- Warming up
- Inerting
- Aerating

Who this unit is for

This unit is for Second Engineers on board Liquefied Natural Gas Carriers.

UNIT D_COFF_4 MONITOR AND REVIEW CARGO CYCLE OPERATIONS

Unit summary

What this unit is about

This unit defines the competence required to monitor and review cargo cycle operations for the entire cargo cycle on board a Liquefied Natural Gas Carrier.

The cargo cycle operations are carried out and monitored at relevant times and critical points. Appropriate changes to the plan are identified where its execution shows shortfalls or problems or raises issues during implementation and appropriate action is taken.

Clear and accurate instructions are given as required and to implement identified changes. The operation is reviewed and evaluated and appropriate feedback given.

Who this unit is for

This unit is for Chief Officers on board Liquefied Natural Gas Carriers.

UNIT D_COFF_4 MONITOR AND REVIEW CARGO CYCLE OPERATIONS

Outcomes of effective performance – you must be able to do the following:

1. Confirm cargo operation details and clarify operational aspects where required to ensure effective and appropriate monitoring activities
2. Carry out and monitor checks at relevant times and critical points, and instruct others as required, to confirm correct and appropriate implementation of the operational plan
3. Identify appropriate changes to the plan where its execution shows shortfalls or problems or raises issues during implementation
4. Take appropriate action to deal with any problems that arise during implementation in line with safety and organisational requirements
5. Instruct others as required and implement identified changes in line with applicable regulations, procedures, guidelines and safety practice
6. Review the operation with relevant personnel and evaluate the potential for safer and more efficient improvements and adaptations
7. Provide feedback to relevant personnel and record appropriate information about the monitoring activity and outcomes of the review in line with organisational requirements

Knowledge and understanding – what you must know

a. What the cargo plan covers and safety and organisational monitoring and review requirements for cargo cycle operations
b. Specific checks required for each operation and their frequency
c. Typical and specific changes that might need to be made to the plan and it's impact on cargo cycle operations
d. The types of problems that may arise and the actions to take to deal with them safely
e. Organisational regulations, procedures, guidelines, recording and safety practice for implementing changes to the plan
f. The roles and numbers of personnel involved in monitoring and review activities

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_COFF_4a D_COFF_4b D_COFF_4c	4 (All)
D_COFF_4d	2.2.3, 2.3.3, 2.4.5, 2.5.4, 2.6.4, 2.7.4, 2.8.4, 2.9.4, 2.10.4, 2.11.4, 2.12.3, 2.13.3, 2.14.3, 2.15.3, 3.1.3, 3.2.3, 3.3.3, 3.4.3, 5.7 (All)
D_COFF_4e	1.3 (All), 1.11 (All), 1.12
D_COFF_4f	1.9 (All)

UNIT D_COFF_5 PLAN FOR AND MANAGE CARGO OPERATIONS UNDER NON-STANDARD CONDITIONS

Unit Summary

What this unit is about

This unit defines the competence required to ensure the effectiveness of cargo operations on Liquefied Natural Gas Carriers under non-standard conditions.

The type, nature and scale of the non-standard condition is determined, the options for dealing with the condition are evaluated, risk assessments are carried out and a plan to deal with the situation formulated in conjunction with other senior officers and superintendents.

Accurate and clear instructions are given to put the determined plan into operation. The effects of the plan are monitored and adjustments made as required. The plan is subsequently reviewed to identify lessons learnt and provide feedback.

The non-standard conditions covered by this unit include, but are not limited to, the following situations:

- Pressurised discharge
- Use of emergency discharge pump
- Single tank gas free
- Ship to Ship Transfer
- Partial loading
- Key equipment not available
- Loss of gas burning capability
- Prolonged loss of power to cargo and ancillary systems

Who this unit is for

This unit is for Chief Officers on board Liquefied Natural Gas Carriers.

UNIT E_CENG_8 ENSURE INTEGRITY OF ELECTRICAL PLANT AND CONTROL SYSTEMS

Unit Summary

What this unit is about

This unit defines the competence required to control the maintenance and repair of marine electrical machinery and control systems on board Liquefied Natural Gas Carriers according to maintenance plans and instructions or as a result of an unacceptable variation.

Equipment and systems are isolated, work areas are confirmed as safe for work to proceed and permit to work and environmental issues and procedures implemented. Machinery and systems are restored to correct settings and work is completed and tested and final checks to ensure maintenance has been effective are carried out. Systems are de-isolated and returned to normal service.

The systems and equipment covered by this unit include, but are not limited to, the following systems, their components and specific features:

- Voltage Systems > 500 V
  - Equipment isolation
  - Earthing arrangements
  - Permit to work systems
- Voltage Systems < 500 V
  - Equipment isolation
  - Permit to work systems
- Electronic and pneumatic control systems
- Electrical equipment in hazardous areas – Ex i, Ex d, Ex p

Who this unit is for

This unit is for Chief Engineers on board Liquefied Natural Gas Carriers.

Outcomes of effective performance – what you must do

1. Prepare a plan to maintain electrical plant and control systems and their components in accordance with established regulations, procedures, guidelines, safety practice, and environmental protection
2. Confirm that work areas, machinery and equipment are safe for work to proceed and comply with legislative requirements, codes of practice, isolation and earthing procedures, permit to work procedures and environmental concerns
3. Control the planned maintenance, checks and tests in accordance with established safety rules and regulations, manufacturers instructions and recognised practice
4. Ensure the integrity of electrical equipment in hazardous areas
5. Ensure that variances from the specification, plans and schedules are correctly identified and that effective corrective action is specified
6. Identify non-standard operating conditions from alarms and other relevant sources and take the appropriate remedial action in a timely and safe manner.
7. Ensure that the equipment or system is restored to the correct settings and specification using the appropriate repair or adjustment method
8. Control the de-isolation procedures to vessel standards, operational requirements and specification
9. Ensure that tests are carried out to verify that equipment and systems meet required performance after maintenance or repair
10. Ensure that documentation and records are completed accurately and to meet future requirements

Knowledge and understanding – what you must know

a. The regulations and guidelines related to the maintenance of electrical and control systems.
b. The safe isolation and earthing procedures applicable to the systems, including the permit to work and isolation systems
c. The types of electrical equipment which may be used in hazardous areas, and the operation and maintenance requirements
d. Operational parameters, specifications, limits and maintenance requirements for electrical and control systems and equipment
e. What constitutes a fault condition and the remedial action that may be required when such conditions are encountered

f. The testing, adjustment and repair methods applicable to electrical and control systems and equipment
g. Record keeping requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_CENG_8a	1.3.1, 1.3.2
E_CENG_8b	3.13 (All), 2.10.5, 2.10.6, 2.11.5, 2.11.6
E_CENG_8c	3.12 (All)
E_CENG_8d E_CENG_8e E_CENG_8f	2.3.4, 2.4.5, 2.5.4, 2.6.3, 2.6.4, 2.7.3, 2.7.4, 2.8.3, 2.8.4, 2.9.3, 2.9.4, 2.10.3, 2.10.4, 2.11.3, 2.11.4, 2.15.3, 2.16.2, 2.17, 2.18, 2.19, 3.3.4, 3.4.2, 3.4.3, 3.5.6, 3.5.7, 3.10.2, 3.11.3, 3.15.1, 3.17.6, 3.17.7, 5.8, 5.13.1, 5.15
E_CENG_8g	1.11 (All)

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_COFF_6a	1.3 (All), 5.1.2, 5.9, 5.10, 5.11, 5.12, 5.13 (All), 5.14, 5.15, 5.16
D_COFF_6b	1.8 (All)
D_COFF_6c	1.10 (All)
D_COFF_6d	1.9 (All)
D_COFF_6e	1.12

UNIT D_COFF_7 ENSURE THE INTEGRITY OF CARGO CONTAINMENT, CARGO EQUIPMENT AND CARGO RELATED SPACES

Unit Summary

What this unit is about

This unit defines the competence required to ensure the integrity of the cargo containment, cargo equipment and cargo related spaces.

The parameters and requirements for each item of cargo equipment and spaces are identified. Equipment operation, maintenance, testing and inspection requirements are identified and verified. Individual responsibilities are identified, and rectifying actions are implemented in the event of problems arising. Accurate and complete records are maintained.

The systems, equipment and spaces covered by this unit include, but are not limited to, the following systems, their components and specific features:

- Air and IG driers
- IG Generator
- N2 generator
- Vaporiser
- HD compressor
- LD compressor
- Gas Heater
- Forcing vaporiser
- Cargo pumps
- Spray pumps
- Cargo tank protection devices
- Cargo line protection devices
- N2 pressurisation and purge
- Cofferdam heating system
- Level gauging system
- Custody Transfer System
- Pneumatic/Hydraulic valve operation
- Emergency discharge pump
- Instrumentation and control systems
- Reliquifaction plant (where applicable)
- Oxidiser (where applicable)
- Regassification plant (Where applicable)
- Cargo tanks
- Hold spaces
- Ballast tanks

Who this unit is for

This unit is for Chief Officers on board Liquefied Natural Gas Carriers.

UNIT D_COFF_7 ENSURE THE INTEGRITY OF CARGO CONTAINMENT, CARGO EQUIPMENT AND CARGO RELATED SPACES

Outcomes of effective performance – what you must do

1. Identify cargo containment operational parameters.
2. Identify the equipment required for cargo operations, its parameters, operating specifications and limits and maintenance requirements.
3. Confirm status of the equipment meets operating parameters and requirements.
4. Identify the function and conditions of cargo related spaces.
5. Confirm appropriate monitoring systems and required tests for cargo containment, cargo equipment and cargo related spaces.
6. Confirm individual responsibilities for maintaining, testing and inspecting cargo containment, cargo equipment and cargo related spaces.
7. Determine an appropriate course of action where problems and issues with effectiveness of the maintenance, testing and inspection are identified and inform the relevant personnel
8. Provide accurate and complete records.

Knowledge and understanding – what you must know

a. Operational parameters for cargo containment
b. Operational parameters, specifications, limits and maintenance requirements for cargo operations equipment
c. Types of cargo related spaces, the functions they serve and what constitutes an appropriate condition for optimum effect
d. Maintenance, tests and inspections required for cargo containment, equipment, monitoring systems and cargo related spaces
e. Individual areas of responsibility
f. Types of problems and issues that may arise, rectifying actions and who needs to be informed
g. Record keeping requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_COFF_7a	2.1 (All)
D_COFF_7b	2.2 (All), 2.3 (All), 2.4 (All), 2.5 (All), 2.6 (All), 2.7 (All), 2.8 (All), 2.9 (All), 2.10 (All), 2.11 (All), 2.12 (All), 2.13 (All), 2.14 (All), 2.15 (All), 2.16 (All), 2.17, 2.18, 2.19, 3.1 (All), 3.2 (All), 3.3.1, 3.3.2, 3.4.1, 3.5 (All), 3.10 (All), 3.11.1, 3.11.2, 3.12.1, 3.14.1
D_COFF_7c	2.20 (All)
D_COFF_7d	3.3.4, 3.4.2, 3.5.7, 3.11.3
D_COFF_7e	1.9 (All)
D_COFF_7f	2.2.3, 2.3.3, 2.4.5, 2.5.4, 2.6.4, 2.7.4, 2.8.4, 2.9.4, 2.10.4, 2.11.4, 2.12.3, 2.13.3, 2.14.3, 2.15.3, 3.1.3, 3.2.3, 3.3.3, 3.4.3
D_COFF_7g	1.11 (All)

UNIT E_CENG_5 ENSURE EFFECTIVENESS OF MAINTENANCE, TESTING AND INSPECTION OF CARGO EQUIPMENT AND SPACES

Outcomes of effective performance – what you must do

1. Accurately identify cargo containment operational parameters.
2. Identify the equipment required for cargo operations, its parameters, operating specifications and limits and maintenance requirements.
3. Confirm status of the equipment meets operating parameters and requirements.
4. Accurately identify the function and conditions of cargo related spaces.
5. Ensure required maintenance, tests and inspections for cargo containment, cargo equipment, monitoring systems and cargo related spaces are effectively carried out.
6. Confirm individual responsibilities for maintaining, testing and inspecting cargo containment, cargo equipment and cargo related spaces
7. Determine an appropriate course of action where problems and issues with effectiveness of the maintenance, testing and inspection are identified and inform the relevant personnel
8. Ensure accurate and complete records are maintained.

Knowledge and understanding – what you must know

a. Operational parameters for cargo containment
b. Operational parameters, specifications, limits and maintenance requirements for cargo operations equipment
c. Types of cargo related spaces, the functions they serve and what constitutes an appropriate condition for optimum effect
d. Maintenance, tests and inspections required for cargo containment, equipment, monitoring systems and cargo related spaces
e. Individual areas of responsibility
f. Types of problems and issues that may arise, rectifying actions and who needs to be informed
g. Record keeping requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_CENG_5a	2.1.2, 2.1.4, 2.1.6
E_CENG_5b E_CENG_5d E_CENG_5f	2.2 (All), 2.3 (All), 2.4 (All), 2.5 (All), 2.6 (All), 2.7 (All), 2.8 (All), 2.9 (All), 2.10 (All), 2.11 (All), 2.12 (All), 2.13 (All), 2.14 (All), 2.15 (All), 2.16 (All), 3.1 (All), 3.2 (All), 3.3 (All), 3.4 (All), 3.5 (All), 3.10 (All), 3.11 (All), 3.12.1, 3.14 (All)
E_CENG_5c	2.20 (All)
E_CENG_5e	1.9 (All)
E_CENG_5g	1.11 (All)

UNIT E_CENG_6 CONTROL THE OPERATION OF GAS-BURNING EQUIPMENT AND ASSOCIATED SYSTEMS.

Unit Summary

What this unit is about

This unit defines the competence required to control the operation of gas burning equipment and associated systems on Liquefied Natural Gas Carriers.

The fuel gas combustion equipment and machinery is operated within safe operating limits and defined parameters and the fuel gas is conditioned as required.

Adjustments are made to the plant as required to maintain specified voyage arrival and loading / delivery cargo conditions.

The gas burning equipment is maintained and tested as required, and non-standard operating conditions are identified and remedial action taken.

Who this unit is for

This unit is for Chief Engineers on board Liquefied Natural Gas Carriers.

UNIT E_CENG_6 CONTROL THE OPERATION OF GAS-BURNING EQUIPMENT AND ASSOCIATED SYSTEMS.

*Outcomes of effective performance – **what you must do***

1. Operate fuel gas combustion equipment and machinery within safe operating limits and defined parameters.
2. Condition the fuel gas to meet design criteria of the particular plant regarding delivery pressure and temperature control.
3. Identify non-standard operating conditions from alarms and other relevant sources and take the appropriate remedial action in a timely and safe manner.
4. Make adjustments to the plant as required to maintain specified voyage arrival and loading / delivery cargo conditions.
5. Maintain and test, within relevant time scales, associated equipment, apparatus, alarm functions, and processes in accordance with applicable regulations, procedures, guidelines and safety practice.

*Knowledge and understanding – **what you must know***

a. Types, design and safe operation of fuel gas combustion equipment and machinery.
b. Fuel gas conditioning methods and systems, the most efficient use of each particular aspect, and when each should be used to best effect.
c. Typical plant parameters and limitations and how they will affect operations.
d. What constitutes a fault condition and the remedial action that may be required when such conditions are encountered.
e. Maintenance, testing and scheduling requirements.
f. Regulations, procedures, guidelines and safety practice.

UNIT D_JOFF_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Unit summary

What this unit is about

This unit defines the competence required to manage the operation, testing and inspection of safety systems and equipment on board Liquefied Natural Gas Carriers.

The equipment parameters are identified, along with maintenance and testing requirements. The individual responsibilities for equipment are confirmed, safety systems and equipment are managed and operated as required in line with regulations, procedures, guidelines and safety practice and records are kept.

The systems and equipment covered by this unit include, but is not limited to the following systems and specific features:

- Emergency shut down system
  - Ship/shore link
  - Fusible plugs/sensors
  - Cargo machinery space flooding system activation
  - Emergency release system
- Water curtain and deck spray
  - Rinsing/testing etc
- Gas detection systems – fixed and portable
  - Proof of functionality
- Fixed dry powder

Who this unit is for

This unit is for Second and Third Officers on board Liquefied Natural Gas Carriers.

UNIT D_JOFF_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Outcomes of effective performance – what you must do

1. Identify the safety systems and equipment required for carriage of LNG, its parameters, operating specifications and limits and maintenance requirements.
2. Confirm that the status of the safety systems and equipment meets operating parameters and requirements.
3. Confirm appropriate monitoring systems and required tests for safety systems and equipment
4. Confirm individual responsibilities for maintaining, testing and inspecting safety systems and equipment
5. Verify the results of maintenance, testing and inspection of safety systems and equipment and where they are not in line with required parameters, determine the relevant action and/or inform the appropriate person.
6. Operate safety systems and equipment as required in line with regulations, procedures, guidelines and safety practice
7. Provide accurate and complete records.

Knowledge and understanding – what you must know

a. Operational parameters, specifications, limits and maintenance requirements for LNG safety systems and equipment
b. Monitoring systems, requirements and tests for safety systems and equipment
c. Individual areas of responsibility
d. The actions to take with non-compliance of safety systems and equipment and who needs to be informed
e. How to operate safety systems and equipment, and the related regulations, procedures, guidelines and safety practice
f. Record keeping requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_JOFF_2a	3.5.1, 3.6, 3.7, 3.8.1, 3.9.1
D_JOFF_2b	3.3.1, 3.3.3, 3.4.1, 3.4.3, 3.14.1
D_JOFF_2c D_JOFF_2d	1.9.1
D_JOFF_2e	1.3.1, 1.3.3
D_JOFF_2f	1.11.1

UNIT D_JOFF_3 EXECUTE PLANNED CARGO CYCLE OPERATIONS

Unit summary

What this unit is about

This unit defines the competence required to execute planned cargo cycle operations on board a Liquefied Natural Gas Carrier.

The stages of the cargo cycle and the planning requirements for each stage are identified. Issues, operational aspects and health and safety considerations which may impact on the plan are confirmed.

The plan is implemented in line with agreed procedures, guidelines and health and safety practice.

The entire cargo cycle from refit to refit is covered, and includes the following cargo cycle stages:

- Cleaning
- Drying
- Inerting
- Purging/gassing up
- Cool down
- Loading
- Loaded passage
- Discharge including heel out
- Ballast passage
- Warming up
- Inerting
- Aerating

Who this unit is for

This unit is for Second and Third Officers on board Liquefied Natural Gas Carriers.

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_CENG_2a	3.5 (All), 3.6, 3.7, 3.8 (All), 3.9 (All)
E_CENG_2b	3.3 (All), 3.4 (All), 3.14 (All)
E_CENG_2c	1.9 (All)
E_CENG_2d	1.9.1
E_CENG_2e	1.3 (All)
E_CENG_2f	1.11 (All)

UNIT E_CENG_3 ENSURE EFFECTIVENESS OF THE ENTIRE CARGO CYCLE

Unit Summary

What this unit is about

This unit defines the competence required to ensure the effectiveness of the entire cargo cycle and the systems and equipment required for cargo cycle operations.

The parameters and requirements for each stage of the cargo cycle are identified. Equipment operation, maintenance, testing and inspection requirements are identified and verified. Individual responsibilities are identified, and rectifying actions are implemented in the event of problems arising. Accurate and complete records are maintained.

The entire cargo cycle from refit to refit is covered, and includes the following cargo cycle stages:

- Cleaning
- Drying
- Inerting
- Purging/gassing up
- Cool down
- Loading
- Loaded passage
- Discharge including heel out
- Ballast passage
- Warming up
- Inerting
- Aerating

Who this unit is for

This unit is for Chief Engineers on board Liquefied Natural Gas Carriers.

UNIT E_CENG_3 ENSURE EFFECTIVENESS OF THE ENTIRE CARGO CYCLE

Outcomes of effective performance – what you must do

1. Identify all cargo cycle operational parameters and the equipment required, operating specifications, limits and maintenance requirements.
2. Confirm status of the equipment meets operating parameters and requirements.
3. Identify the function and conditions of cargo related spaces and confirm appropriate monitoring systems and required tests for cargo containment, cargo equipment and cargo related spaces.
4. Confirm individual responsibilities for maintaining, testing and inspecting cargo containment, cargo equipment and cargo related spaces and that they are operated in line with required parameters.
5. Determine and take an appropriate course of action where deviations from normal parameters of the cargo cycle are identified and inform the relevant personnel.
6. Ensure accurate and complete records are maintained.

Knowledge and understanding – what you must know

a. Operational parameters for each stage of the cargo cycle
b. Operational parameters, specifications, limits and maintenance requirements for cargo cycle equipment
c. Types of cargo related spaces, the functions they serve and what constitutes an appropriate condition for optimum effect
d. Monitoring systems, requirements and tests for cargo containment, cargo equipment and cargo related spaces
e. Individual areas of responsibility
f. Types of deviations that may arise, rectifying actions and who needs to be informed
g. Record keeping requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_CENG_3a	4 (All)
E_CENG_3b	2.2.1, 2.2.2, 2.2.4, 2.3.1, 2.3.2, 2.3.3, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.5.1, 2.5.2, 2.5.3, 2.6.1, 2.6.2, 2.6.3, 2.7.1, 2.7.2, 2.7.3, 2.8.1, 2.8.2, 2.8.3, 2.9.1, 2.9.2, 2.9.3, 2.10.1, 2.10.2, 2.10.3, 2.11.1, 2.11.2, 2.11.3, 2.12.1, 2.12.2, 2.13.1, 2.13.2, 2.14.1, 2.14.2, 2.15.1, 2.15.2, 2.16 (All), 2.17, 2.18, 2.19, 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.5 (All)
E_CENG_3c	2.20 (All)
E_CENG_3d	3.3 (All), 3.4 (All), 3.10 (All), 3.11 (All), 3.14 (All)
E_CENG_3e	1.9 (All)
E_CENG_3f	1.9.1, 2.2.3, 2.3.4, 2.4.5, 2.5.4, 2.6.4, 2.7.4, 2.8.4, 2.9.4, 2.10.4, 2.11.4, 2.12.3, 2.13.3, 2.14.3, 2.15.3, 3.1.3, 3.2.3, 3.3.3, 3.4.3, 5.7 (All)
E_CENG_3g	1.11 (All)

UNIT D_CARENG_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Outcomes of effective performance - You must be able to do the following:

1. Identify the properties and characteristics of liquefied and other relevant gases and determine their impact on safety and vessel operations
2. Identify the regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment and determine the impact on cargo storage, transportation and containment
3. Determine specific loading and discharging features and cargo cycles and confirm individual responsibilities for those involved
4. Identify the ship to shore interface and equipment and determine any issues they might raise during vessel and cargo operations
5. Confirm the specific vessel and cargo operations risk assessment requirements and processes for those involved

Knowledge and understanding – what you must know

a. The properties and characteristics of liquefied and other relevant gases
b. Personnel safety, vessel safety and environmental considerations related to the carriage of LNG
c. The regulations and guidelines related to the carriage of LNG at sea
d. The features of LNG ship design and safety systems, how and why they differ from other typical ship design and safety features and the differences they make to ship operations, ship handling and cargo storage
e. LNG propulsion system types, typical operating parameters and specific features and how they relate to the method of cargo management
f. The materials used on LNG ships, where they are used and why they are suitable for their purpose
g. Cargo tank filling capacities, limitations and associated features
h. Specific features and commercial implications, including vetting and other inspections, associated with LNG storage, containment, measurement, loading, discharging and cargo cycles
i. How different types of ship to shore interface processes and equipment might impact on vessel, mooring and cargo operations
j. Safe and efficient LNG ballast-handling practices
k. LNG-specific risk assessment requirements and processes
l. Individual areas of responsibility

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_CARENG_1a	1.1 (All)
D_CARENG_1b	1.4, 1.6 (All), 1.7 (All)
D_CARENG_1c	1.3 (All), 6.1.6
D_CARENG_1d	1.2 (All), 2.1 (All), 3.12.1, 5.1 (All)
D_CARENG_1e	3.16 (All), 3.17.1, 3.17.2, 3.17.3, 3.17.5
D_CARENG_1f	1.5 (All)
D_CARENG_1g	3.10 (All)
D_CARENG_1h	3.11 (All), 6.2.1
D_CARENG_1i	3.5 (All), 3.6, 4.5 (All)
D_CARENG_1j	4.8.3, 4.10.4
D_CARENG_1k	1.8 (All)
D_CARENG_1l	1.9 (All)

UNIT D_CARENG_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Unit summary

What this unit is about

This unit defines the competence required to manage the operation, testing and inspection of safety systems and equipment on board Liquefied Natural Gas Carriers.

The equipment parameters are identified, along with maintenance and testing requirements. The individual responsibilities for equipment are confirmed, safety systems and equipment are managed and operated as required in line with regulations, procedures, guidelines and safety practice and records are kept.

The systems and equipment covered by this unit include, but is not limited to the following systems and specific features:

- Emergency shut down system
  - Ship/shore link
  - Fusible plugs/sensors
  - Cargo machinery space flooding system activation
  - Emergency release system
- Water curtain and deck spray
  - Rinsing/testing etc
- Gas detection systems – fixed and portable
  - Proof of functionality
- Fixed dry powder

Who this unit is for

This unit is for Cargo Engineers on board Liquefied Natural Gas Carriers.

UNIT D_CARENG_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Outcomes of effective performance – what you must do

1. Identify the safety systems and equipment required for carriage of LNG, its parameters, operating specifications and limits and maintenance requirements.
2. Confirm that the status of the safety systems and equipment meets operating parameters and requirements.
3. Confirm appropriate monitoring systems and required tests for safety systems and equipment
4. Confirm individual responsibilities for maintaining, testing and inspecting safety systems and equipment
5. Verify the results of maintenance, testing and inspection of safety systems and equipment and where they are not in line with required parameters, determine the relevant action and/or inform the appropriate person.
6. Operate safety systems and equipment as required in line with regulations, procedures, guidelines and safety practice
7. Provide accurate and complete records.

Knowledge and understanding – what you must know

a. Operational parameters, specifications, limits and maintenance requirements for LNG safety systems and equipment
b. Monitoring systems, requirements and tests for safety systems and equipment
c. Individual areas of responsibility
d. The actions to take with non-compliance of safety systems and equipment and who needs to be informed
e. How to operate safety systems and equipment, and the related regulations, procedures, guidelines and safety practice
f. Record keeping requirements

UNIT D_CARENG_5 MAINTAIN THE INTEGRITY OF CARGO CONTAINMENT, CARGO EQUIPMENT AND CARGO RELATED SPACES

Outcomes of effective performance – what you must do

1. Identify cargo containment operational parameters.
2. Identify the equipment required for cargo operations, its normal parameters, operating specifications and limits and maintenance requirements.
3. Identify the function and conditions of cargo related spaces.
4. Confirm individual responsibilities for maintaining, testing and inspecting cargo containment, cargo equipment and cargo related spaces.
5. Ensure that the status of the equipment and monitoring systems within own area of responsibility meets operating parameters and requirements.
6. Carry out required tests for cargo containment, cargo equipment and cargo related spaces within own area of responsibility.
7. Determine an appropriate course of action where problems and issues with effectiveness of the maintenance, testing and inspection are identified and inform the relevant personnel
8. Provide accurate and complete records.

Knowledge and understanding – what you must know

a. Operational parameters for cargo containment
b. Operational parameters, specifications, limits and maintenance requirements for cargo operations equipment
c. Types of cargo related spaces, the functions they serve and what constitutes a normal operational condition
d. Maintenance, tests and inspections required for cargo containment, equipment, monitoring systems and cargo related spaces
e. Individual areas of responsibility
f. Types of problems and issues that may arise, rectifying actions and who needs to be informed
g. Record keeping requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_CARENG_5a	2.1.2, 2.1.4, 2.1.6
D_CARENG_5b D_CARENG_5d D_CARENG_5f	2.2 (All), 2.3 (All), 2.4 (All), 2.5 (All), 2.6 (All), 2.7 (All), 2.8 (All), 2.9 (All), 2.10 (All), 2.11 (All), 2.12 (All), 2.13 (All), 2.14 (All), 2.15 (All), 2.16 (All), 3.1 (All), 3.2 (All), 3.3 (All), 3.4 (All), 3.5 (All), 3.10 (All), 3.11 (All), 3.12.1, 3.14 (All)
D_CARENG_5c	2.20 (All)
D_CARENG_5e	1.9 (All)
D_CARENG_5g	1.11.1

CHIEF ENG

UNIT E_CENG_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Unit summary

What this unit is about

This unit defines the competence required to develop familiarisation and understanding of LNG transportation requirements.

The properties of liquefied and other relevant gases and their impact on safety and vessel operations are identified and determined.

The regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment are identified and their impact on cargo storage, transportation and containment is determined.

The complete cargo cycle is identified, and the cargo equipment required for each cargo cycle stage is identified including any specific features and issues which may arise in operation.

Individual responsibilities and the specific vessel and cargo operations risk assessment requirements and processes are confirmed.

Who this unit is for

This unit is for Chief Engineers on board Liquefied Natural Gas Carriers.

UNIT D_CARENG_4 EXECUTE AND MONITOR CARGO OPERATIONS UNDER NON-STANDARD AND EMERGENCY CONDITIONS

Unit Summary

What this unit is about

This unit defines the competence required to execute and monitor cargo operations on Liquefied Natural Gas Carriers under non-standard and emergency conditions.

The type, nature and scale of the non-standard condition or emergency is determined, assistance is given in identifying the options for dealing with the condition and carrying out risk assessments.

The determined plan is executed, the effects of the plan are monitored and adjustments to appropriate equipment made as required. Assistance is subsequently given to reviewing the plan, identifying lessons learnt and providing feedback.

The non-standard conditions covered by this unit include, but are not limited to, the following situations:

- Pressurised discharge
- Use of emergency discharge pump
- Single tank gas free
- Ship to Ship Transfer
- Partial loading
- Key equipment not available
- Loss of gas burning capability
- Prolonged loss of power to cargo and ancillary systems

The emergency conditions covered by this unit include, but are not limited to, the following situations:

- Loss of Primary Barrier integrity
- Ballast tank leakage into containment space
- Nitrogen supply failure
- Jettisoning cargo
- Overfilling a cargo tank
- Failure of integrated automation system
- Uncontrolled release of cargo
- Loss of cargo pipeline containment

Who this unit is for

This unit is for Cargo Engineers on board Liquefied Natural Gas Carriers.

UNIT D_CARENG_4 EXECUTE AND MONITOR CARGO OPERATIONS UNDER NON-STANDARD AND EMERGENCY CONDITIONS

Outcomes of effective performance – what you must do

1. Confirm that the type, nature and scale of the condition is correctly determined from alarms and relevant sources
2. Assist in identifying the options for how to deal safely and in a controlled manner with the condition
3. Contribute to risk assessments and planning for each option
4. Identify activities and responsibilities of those involved and execute the specified plan in a timely and safe manner
5. Monitor the effects of the plan, identify and ensure that appropriate adjustments to equipment are made as required
6. Contribute to reviewing the plan and operational procedures at the appropriate time and identify lessons learnt and provide feedback to relevant people

Knowledge and understanding – what you must know

a. Types of non-standard conditions and emergencies and the applicable regulations, procedures, guidelines and safety practice for dealing with them

b. How to carry out risk assessments

c. How to execute contingency plans

d. Individual levels of responsibility and the importance of checking and confirming understanding of instructions given

e. The importance of reviewing the plan and course of action taken

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_CARENG_4a	1.3 (All), 5 (All), 3.14.2
D_CARENG_4b	1.8 (All)
D_CARENG_4c	1.10 (All)
D_CARENG_4d	1.9 (All)
D_CARENG_4e	1.12

UNIT D_CARENG_5 MAINTAIN THE INTEGRITY OF CARGO CONTAINMENT, CARGO EQUIPMENT AND CARGO RELATED SPACES

Unit Summary

What this unit is about

This unit defines the competence required to ensure the integrity of the cargo containment, cargo equipment and cargo related spaces.

The parameters and requirements for each item of cargo equipment and spaces are identified. Equipment operation, maintenance, testing and inspection requirements are identified and verified. Individual responsibilities are identified, and rectifying actions are implemented in the event of problems arising. Accurate and complete records are maintained.

The systems, equipment and spaces covered by this unit include, but are not limited to, the following systems, their components and specific features:

- Air and IG driers
- IG Generator
- N2 generator
- Vaporiser
- HD compressor
- LD compressor
- Gas Heater
- Forcing vaporiser
- Cargo pumps
- Spray pumps
- Cargo tank protection devices
- Cargo line protection devices
- N2 pressurisation and purge
- Cofferdam heating system
- Level gauging system
- Custody Transfer System
- Pneumatic/Hydraulic valve operation
- Emergency discharge pump
- Instrumentation and control systems
- Reliquifaction plant (where applicable)
- Oxidiser (where applicable)
- Regassification plant (Where applicable)
- Cargo tanks
- Hold spaces

Who this unit is for

This unit is for Cargo Engineers on board Liquefied Natural Gas Carriers.

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_CARENG_2a	3.5 (All), 3.6, 3.7, 3.8 (All), 3.9 (All)
D_CARENG_2b	3.3 (All), 3.4 (All), 3.14.1
D_CARENG_2c D_CARENG_2d	1.9.1
D_CARENG_2e	1.3.1, 1.3.3
D_CARENG_2f	1.11.1

UNIT D_CARENG_3 EXECUTE PLANNED CARGO CYCLE OPERATIONS

Unit summary

What this unit is about

This unit defines the competence required to execute planned cargo cycle operations on board a Liquefied Natural Gas Carrier.

The stages of the cargo cycle and the requirements for each stage are identified. Issues, operational aspects and health and safety considerations which may impact on the plan are confirmed.

The plan is implemented in line with agreed procedures, guidelines and health, safety and environmental practice

The entire cargo cycle is covered, and includes the following stages:

- Cleaning
- Drying
- Inerting
- Purging/gassing up
- Cool down
- Loading
- Loaded passage
- Discharge including heel out
- Ballast passage
- Warming up
- Inerting
- Aerating

Who this unit is for

This unit is for Cargo Engineers on board Liquefied Natural Gas Carriers.

UNIT D_CARENG_3 EXECUTE PLANNED CARGO CYCLE OPERATIONS

Outcomes of effective performance – you must be able to do the following:

1. Determine activities and own responsibilities involved in specific cargo cycle operations from plans provided and instructions received.
2. Confirm with those involved in the planned operation that they understand the responsibilities of others where relevant
3. Prepare for and carry out operational activities in line with planned procedures, guidelines, health, safety and environmental practice
4. Operate all cargo machinery in accordance with organisational and manufacturers guidelines and system parameters
5. Carry out and monitor checks at relevant times and critical points, and advise others as required, to confirm correct and appropriate implementation of the operational plan
6. Identify non-standard and emergency operating conditions from alarms and other relevant sources and take relevant action and/or inform the appropriate person in a timely and safe manner.
7. Provide feedback to relevant personnel and record appropriate information

Knowledge and understanding – what you must know

a. Cargo cycle stages, what the cargo plan covers, safety and organisational monitoring requirements for cargo cycle operations
b. The typical and usual issues and operational aspects that could have an impact on the plan
c. Specific checks required for each operation and their frequency
d. Individual responsibilities for all aspects of the cargo cycle
e. The operating procedures, operational parameters and limitations of cargo machinery and systems
f. Implementation procedures, guidelines and health, safety and environmental practice

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_CARENG_3a D_CARENG_3b D_CARENG_3c	4 (All)
D_CARENG_3d	1.9.1
D_CARENG_3e	2 (All), 3.1 (All), 3.2 (All), 3.3 (All), 3.4 (All), 3.5 (All), 3.10 (All), 3.11 (All), 3.17 (All)
D_CARENG_3f	1.3 (All)

UNIT E_CENG_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Outcomes of effective performance – what you must do:

1. Identify the properties and characteristics of liquefied and other relevant gases and determine their impact on safety and vessel operations
2. Identify the regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment and determine the impact on cargo storage, transportation and containment
3. Determine specific loading and discharging features and cargo cycles and confirm individual responsibilities for those involved
4. Identify the ship to shore interface and equipment and determine any issues they might raise during vessel and cargo operations
5. Confirm the specific vessel and cargo operations risk assessment requirements and processes for those involved

Knowledge and understanding – what you must know

a. The properties and characteristics of liquefied and other relevant gases
b. Personnel safety, vessel safety and environmental considerations related to the carriage of LNG
c. The regulations and guidelines related to the carriage of LNG at sea
d. The features of LNG ship design and safety systems, how and why they differ from other typical ship design and safety features and the differences they make to ship operations, ship handling and cargo storage
e. LNG propulsion system types, typical operating parameters and specific features and how they relate to the method of cargo management
f. The materials used on LNG ships, where they are used and why they are suitable for their purpose
g. Cargo tank filling capacities, limitations and associated features
h. Specific features and commercial implications, including vetting and other inspections, associated with LNG storage, containment, measurement, loading, discharging and cargo cycles
i. How different types of ship to shore interface processes and equipment might impact on vessel, mooring and cargo operations
j. Safe and efficient LNG ballast-handling practices
k. LNG-specific risk assessment requirements and processes
l. Individual areas of responsibility

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_CENG_1a	1.1 (All)
E_CENG_1b	1.4, 1.6 (All), 1.7 (All)
E_CENG_1c	1.3 (All), 6.1.6
E_CENG_1d	1.2 (All), 2.1(All), 3.12.1, 5.1 (All)
E_CENG_1e	3.16 (All), 3.17.1, 3.17.2, 3.17.3, 3.17.5
E_CENG_1f	1.5 (All)
E_CENG_1g	3.10 (All)
E_CENG_1h	3.11 (All), 6.1.5, 6.2 (All)
E_CENG_1i	3.5 (All), 3.6, 4.5 (All)
E_CENG_1j	4.8.3, 4.10.4
E_CENG_1k	1.8 (All)
E_CENG_1l	1.9 (All)

UNIT E_CENG_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Unit summary

What this unit is about

This unit defines the competence required to manage the operation, testing and inspection of safety systems and equipment on board Liquefied Natural Gas Carriers.

The equipment parameters are identified, along with maintenance and testing requirements. The individual responsibilities for equipment are confirmed, safety systems and equipment are managed and operated as required in line with regulations, procedures, guidelines and safety practice and records are kept.

The systems and equipment covered by this unit include, but is not limited to the following systems and specific features:

- Emergency shut down system
  - Ship/shore link
  - Fusible plugs/sensors
  - Cargo machinery space flooding system activation
  - Emergency release system
- Water curtain and deck spray
  - Rinsing/testing etc
- Gas detection systems – fixed and portable
  - Proof of functionality
- Fixed dry powder

Who this unit is for

This unit is for Chief Engineers on board Liquefied Natural Gas Carriers.

UNIT E_CENG_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Outcomes of effective performance – what you must do

1. Identify the safety systems and equipment required for carriage of LNG, its parameters, operating specifications and limits and maintenance requirements.
2. Confirm that the status of the safety systems and equipment meets operating parameters and requirements.
3. Confirm appropriate monitoring systems and required tests for safety systems and equipment
4. Confirm individual responsibilities for maintaining, testing and inspecting safety systems and equipment
5. Verify the results of maintenance, testing and inspection of safety systems and equipment and where they are not in line with required parameters, determine the relevant action and/or inform the appropriate person.
6. Operate safety systems and equipment as required in line with regulations, procedures, guidelines and safety practice
7. Provide accurate and complete records.

Knowledge and understanding – what you must know

a. Operational parameters, specifications, limits and maintenance requirements for LNG safety systems and equipment
b. Monitoring systems, requirements and tests for safety systems and equipment
c. Individual areas of responsibility
d. The actions to take with non-compliance of safety systems and equipment and who needs to be informed
e. How to operate safety systems and equipment, and the related regulations, procedures, guidelines and safety practice
f. Record keeping requirements

UNIT D_JOFF_3 EXECUTE PLANNED CARGO CYCLE OPERATIONS

Outcomes of effective performance – you must be able to do the following:

1. Determine activities and own responsibilities involved in cargo cycle operations from plans provided and instructions received
2. Confirm with those involved in the planned operation that they understand the responsibilities of others where relevant
3. Carry out operational activities in line with planned procedures, guidelines and health and safety practice
4. Carry out and monitor checks at relevant times and critical points, and instruct others as required, to confirm correct and appropriate implementation of the operational plan
5. Identify non-standard and emergency operating conditions from alarms and other relevant sources and take relevant action and/or inform the appropriate person in a timely and safe manner
6. Provide feedback to relevant personnel and record appropriate information

Knowledge and understanding – what you must know

a. Cargo cycle stages, what the cargo plan covers, safety and organisational monitoring requirements for cargo cycle operations
b. The typical and usual issues and operational aspects that could have an impact on the plan
c. Specific checks required for each operation and their frequency
d. Individual responsibilities for all aspects of the cargo cycle
e. Implementation procedures, guidelines and health and safety practice
f. What constitutes non-standard and emergency conditions, the initial action to take and the importance of informing the appropriate person

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_JOFF_3a D_JOFF_3b D_JOFF_3c	4.1.1, 4.2.1, 4.3.1, 4.4.1, 4.5.1, 4.5.2, 4.5.4, 4.6.1, 4.7.1, 4.8.1, 4.8.3, 4.9.1, 4.10.1, 4.10.4, 4.11.1, 4.12.1, 4.13.1
D_JOFF_3d	1.9.1
D_JOFF_3e	1.3.1, 1.3.3
D_JOFF_3f	1.10.1, 5.1.1

CARGO ENG

UNIT D_CARENG_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Unit summary

What this unit is about

This unit defines the competence required to develop familiarisation and understanding of LNG transportation requirements.

The properties of liquefied and other relevant gases and their impact on safety and vessel operations are identified and determined.

The regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment are identified and their impact on cargo storage, transportation and containment is determined.

The complete cargo cycle is identified, and the cargo equipment required for each cargo cycle stage is identified including any specific features and issues which may arise in operation.

Individual responsibilities and the specific vessel and cargo operations risk assessment requirements and processes are confirmed.

Who this unit is for

This unit is for Cargo Engineers on board Liquefied Natural Gas Carriers.

UNIT E_CENG_4 ENSURE EFFECTIVENESS OF CARGO OPERATIONS UNDER NON-STANDARD AND EMERGENCY CONDITIONS

Unit Summary

What this unit is about

This unit defines the competence required to ensure the effectiveness of cargo operations on Liquefied Natural Gas Carriers under non-standard and emergency conditions.

The type, nature and scale of the non-standard condition or emergency is determined, the options for dealing with the condition are evaluated, risk assessments are carried out and a plan to deal with the situation formulated in conjunction with other senior officers and superintendents.

Accurate and clear instructions are given to put the determined plan into operation. The effects of the plan are monitored and adjustments made as required. The plan is subsequently reviewed to identify lessons learnt and provide feedback.

The non-standard conditions covered by this unit include, but are not limited to, the following situations:

- Pressurised discharge
- Use of emergency discharge pump
- Single tank gas free
- Ship to Ship Transfer
- Partial loading
- Key equipment not available
- Loss of gas burning capability
- Prolonged loss of power to cargo and ancillary systems

The emergency conditions covered by this unit include, but are not limited to, the following situations:

- Loss of Primary Barrier
- Ballast tank leakage into containment space
- Nitrogen supply failure
- Jettisoning cargo
- Overfilling a cargo tank
- Failure of integrated automation system
- Uncontrolled release of cargo
- Loss of cargo pipeline containment

Who this unit is for

This unit is for Chief Engineers on board Liquefied Natural Gas Carriers.

UNIT E_CENG_4 ENSURE EFFECTIVENESS OF CARGO OPERATIONS UNDER NON-STANDARD AND EMERGENCY CONDITIONS

Outcomes of effective performance – what you must do

1. Confirm that the type, nature and scale of the condition is correctly determined from alarms and relevant sources
2. Ensure the correct options for how to deal safely and in a controlled manner with the condition are identified
3. Ensure that risk assessments and planning for each option are carried out and that the most appropriate plan and course of action to deal with the situation is determined
4. Ensure that accurate and clear instructions and information are provided to relevant people to carry out the plan
5. Ensure that the determined plan is put into operation in a timely and safe manner
6. Monitor the effects of the plan as required, identify and ensure that appropriate adjustments are made
7. Review the plan and operational procedures at the appropriate time and identify lessons learnt and provide feedback to relevant people and organisations.

Knowledge and understanding – what you must know

a. Types of non-standard conditions and emergencies and the applicable regulations, procedures, guidelines and safety practice for dealing with them
b. How to carry out risk assessments
c. How to formulate, adjust and implement contingency plans
d. Individual levels of responsibility and the importance of checking and confirming understanding of instructions given
e. The importance of reviewing the plan and course of action taken

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_CENG_4a	1.3 (All), 5 (All), 3.14.2
E_CENG_4b	1.8 (All)
E_CENG_4c	1.10 (All)
E_CENG_4d	1.9 (All)
E_CENG_4e	1.12 (All)

UNIT E_CENG_5 ENSURE EFFECTIVENESS OF MAINTENANCE, TESTING AND INSPECTION OF CARGO EQUIPMENT AND SPACES

Unit Summary

What this unit is about

This unit defines the competence required to make sure that the maintenance, testing and inspection of cargo equipment and spaces is effectively carried out by all those involved.

The parameters and requirements for each item of cargo equipment and spaces are identified. Equipment operation, maintenance, testing and inspection requirements are identified and verified. Individual responsibilities are identified, and rectifying actions are implemented in the event of problems arising. Accurate and complete records are maintained.

The systems, equipment and spaces covered by this unit include, but are not limited to, the following systems, their components and specific features:

- Air and IG driers
- IG Generator
- N2 generator
- LNG Vaporiser
- HD compressor
- LD compressor
- Gas Heater
- Forcing vaporiser
- Cargo pumps
- Spray pumps
- Cargo tank protection devices
- Cargo line protection devices
- N2 pressurisation and purge
- Cofferdam heating system
- Level gauging system
- Custody Transfer System
- Pneumatic/Hydraulic valve operation
- Emergency discharge pump
- Instrumentation and control systems
- Reliquifaction plant
- Oxidiser
- Regassification plant
- Cargo tanks
- Hold spaces
- Ballast tanks

Who this unit is for

This unit is for Chief Engineers on board Liquefied Natural Gas Carriers.

2ND/3RD OFFICERS

UNIT D_JOFF_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Unit summary

What this unit is about

This unit defines the competence required to develop familiarisation and understanding of LNG transportation requirements.

The properties of liquefied and other relevant gases and their impact on safety and vessel operations are identified and determined.

The regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment are identified and their impact on cargo storage, transportation and containment is determined.

The complete cargo cycle is identified, and the cargo equipment required for each cargo cycle stage is identified including any specific features and issues which may arise in operation.

Individual responsibilities and the specific vessel and cargo operations risk assessment requirements and processes are confirmed.

Who this unit is for

This unit is for Second and Third Officers on board Liquefied Natural Gas Carriers.

UNIT D_JOFF_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Outcomes of effective performance - You must be able to do the following:

1. Identify the properties and characteristics of liquefied and other relevant gases and determine their impact on safety and vessel operations
2. Identify the regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment and determine the impact on cargo storage, transportation and containment
3. Determine specific loading and discharging features and cargo cycles and confirm individual responsibilities for those involved
4. Identify the ship to shore interface and equipment and determine any issues they might raise during vessel and cargo operations
5. Confirm the specific vessel and cargo operations risk assessment requirements and processes for those involved

Knowledge and understanding – what you must know

a. The properties and characteristics of liquefied and other relevant gases
b. Personnel safety, vessel safety and environmental considerations related to the carriage of LNG
c. The regulations and guidelines related to the carriage of LNG at sea
d. The features of LNG ship design and safety systems, how and why they differ from other typical ship design and safety features and the differences they make to ship operations, ship handling and cargo storage
e. LNG propulsion system types, typical operating parameters and specific features and how they relate to the method of cargo management
f. The materials used on LNG ships, where they are used and why they are suitable for their purpose
g. Cargo tank filling capacities, limitations and associated features
h. Specific features and commercial implications, including vetting and other inspections, associated with LNG storage, containment, measurement, loading, discharging and cargo cycles
i. How different types of ship to shore interface processes and equipment might impact on vessel, mooring and cargo operations
j. Safe and efficient LNG ballast-handling practices
k. LNG-specific risk assessment requirements and processes
l. Individual areas of responsibility

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_JOFF_1a	1.1.1, 1.1.3
D_JOFF_1b	1.4, 1.6.1, 1.6.3, 1.7.1
D_JOFF_1c	1.3.1, 1.3.3
D_JOFF_1d	1.2.1, 2.1.1, 2.1.3, 3.12.1, 5.1 (All)
D_JOFF_1e	3.16.1
D_JOFF_1f	1.5.1
D_JOFF_1g	3.10.1
D_JOFF_1h	3.11.1, 6.2.1
D_JOFF_1i	3.5.1, 3.6, 4.5.1, 4.5.4
D_JOFF_1j	4.8.3, 4.10.4
D_JOFF_1k	1.8.1
D_JOFF_1l	1.9.1

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_CENG_6a E_CENG_6b E_CENG_6d E_CENG_6e	1.11.2, 2.18, 3.17 (All)
E_CENG_6c	2.5 (All), 2.7 (All), 2.8 (All), 2.9 (All), 2.11.3
E_CENG_6f	1.3 (All)

UNIT E_CENG_7 CONTROL OPERATION OF THE PROPULSION PLANT UNDER NON-STANDARD CONDITIONS

Unit Summary

What this unit is about

This unit defines the competence required to control the operation of each type of propulsion plant on Liquefied Natural Gas Carriers under non-standard conditions.

The type, nature and scale of the non-standard condition is determined, the options for dealing with the condition are evaluated, risk assessments are carried out and a plan to deal with the situation formed.

Accurate and clear instructions are given to put the determined plan into operation. The effects of the plan are monitored and adjustments made as required. The plan is subsequently reviewed to identify lessons learnt and provide feedback.

The non-standard conditions covered by this unit include, but are not limited to, the following situations:

- Manual firing
- Loss of Nitrogen gas supply
- Loss of fuel gas pressure
- Leaks within gas hoods or ducts
- Inability to operate the steam dump facility or thermal oxidiser where applicable
- Loss of LD gas compressors, heaters, vaporisers etc
- Key equipment not available

Who this unit is for

This unit is for Chief Engineers on board Liquefied Natural Gas Carriers.

UNIT E_CENG_7 CONTROL OPERATION OF THE PROPULSION PLANT UNDER NON-STANDARD CONDITIONS

Outcomes of effective performance – what you must do

1. Determine the type, nature and scale of the condition from alarms and relevant sources
2. Identify the options for how to deal safely and in a controlled manner with the condition
3. Carry out risk assessments and planning for each option and determine the most appropriate plan/course of action to deal with the situation
4. Provide accurate and clear instructions and information to relevant people to carry out the plan
5. Put the determined plan into operation in a timely and safe manner
6. Monitor the effects of the plan as required, identify and make adjustments according to the effect on the condition
7. Review the plan and operational procedures at the appropriate time and identify lessons learnt and provide feedback to relevant people and organisations.

Knowledge and understanding – what you must know

a. Types of non-standard conditions and applicable regulations, procedures, guidelines and safety practice for dealing with them
b. How to carry out risk assessments
c. How to formulate, adjust and implement contingency plans
d. Individual levels of responsibility and the importance of checking and confirming understanding of instructions given
e. The importance of reviewing the plan and course of action taken

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_CENG_7a	1.3.1, 1.3.2, 5.7
E_CENG_7b	1.8 (All)
E_CENG_7c	1.10 (All)
E_CENG_7d	1.9 (All)
E_CENG_7e	1.12 (All)

UNIT D_COFF_5 PLAN FOR AND MANAGE CARGO OPERATIONS UNDER NON-STANDARD CONDITIONS

Outcomes of effective performance – what you must do

1. Determine the type, nature and scale of the condition from alarms and relevant sources
2. Identify the options for how to deal safely and in a controlled manner with the condition
3. Carry out risk assessments and planning for each option and determine the most appropriate plan and course of action to deal with the situation
4. Provide accurate and clear instructions and information to relevant people to carry out the plan
5. Put the determined plan into operation in a timely and safe manner
6. Monitor the effects of the plan as required, identify and make appropriate adjustments
7. Review the plan and operational procedures at the appropriate time and identify lessons learnt and provide feedback to relevant people

Knowledge and understanding – what you must know

a. Types of non-standard conditions and applicable regulations, procedures, guidelines and safety practice for dealing with them
b. How to carry out risk assessments
c. How to formulate, adjust and implement contingency plans
d. Individual levels of responsibility and the importance of checking and confirming understanding of instructions given
e. The importance of reviewing the plan and course of action taken

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_COFF_5a	1.3 (All), 5.1.1, 5.2 (All), 5.3, 5.4, 5.5, 5.6, 5.7, 5.8.1
D_COFF_5b	1.8 (All)
D_COFF_5c	1.10 (All)
D_COFF_5d	1.9 (All)
D_COFF_5e	1.12

UNIT D_COFF_6 PLAN FOR AND MANAGE CARGO OPERATIONS UNDER EMERGENCY CONDITIONS

Unit Summary

What this unit is about

This unit defines the competence required to ensure the effectiveness of cargo operations on Liquefied Natural Gas Carriers under emergency conditions.

The type, nature and scale of the emergency condition is determined, the options for dealing with the condition are evaluated, risk assessments are carried out and a plan to deal with the situation formulated in conjunction with other senior officers and superintendents.

Accurate and clear instructions are given to put the determined plan into operation. The effects of the plan are monitored and adjustments made as required. The plan is subsequently reviewed to identify lessons learnt and provide feedback.

The emergency conditions covered by this unit include, but are not limited to, the following situations:

- Loss of Primary Barrier
- Ballast tank leakage into containment space
- Nitrogen supply failure
- Jettisoning cargo
- Overfilling a cargo tank
- Failure of integrated automation system
- Uncontrolled release of cargo
- Loss of cargo pipeline containment

Who this unit is for

This unit is for Chief Officers on board Liquefied Natural Gas Carriers.

UNIT D_COFF_6 PLAN FOR AND MANAGE CARGO OPERATIONS UNDER EMERGENCY CONDITIONS

Outcomes of effective performance – what you must do

1. Determine the type, nature and scale of the emergency from alarms and relevant sources
2. Identify the options, carry out risk assessments and determine the appropriate course of action to deal safely and in a controlled manner with the emergency
3. Provide accurate and clear instructions and information to relevant people to deal with the emergency
4. Monitor the actions being carried out, confirm the desired effect and determine necessary corrective actions where required.
5. Confirm the emergency condition is being managed and the situation mitigated.
6. Provide accurate and complete records.

Knowledge and understanding – what you must know

a. Types of emergency conditions and applicable regulations, procedures, guidelines and safety practice for dealing with them
b. How to carry out risk assessments
c. How to formulate, adjust and implement contingency plans
d. Individual levels of responsibility and the importance of checking and confirming understanding of instructions given
e. The importance of reviewing the plan and course of action taken

2nd ENG

UNIT E_2ENG_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Unit summary

What this unit is about

This unit defines the competence required to develop familiarisation and understanding of LNG transportation requirements.

The properties of liquefied and other relevant gases and their impact on safety and vessel operations are identified and determined.

The regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment are identified and their impact on cargo storage, transportation and containment is determined.

The complete cargo cycle is identified, and the cargo equipment required for each cargo cycle stage is identified including any specific features and issues which may arise in operation.

Individual responsibilities and the specific vessel and cargo operations risk assessment requirements and processes are confirmed.

Who this unit is for

This unit is for Second Engineers on board Liquefied Natural Gas Carriers.

UNIT E_2ENG_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Outcomes of effective performance – what you must do:

1. Identify the properties and characteristics of liquefied and other relevant gases and determine their impact on safety and vessel operations
2. Identify the regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment and determine the impact on cargo storage, transportation and containment
3. Determine specific loading and discharging features and cargo cycles and confirm individual responsibilities for those involved
4. Identify the ship to shore interface and equipment and determine any issues they might raise during vessel and cargo operations
5. Confirm the specific vessel and cargo operations risk assessment requirements and processes for those involved

Knowledge and understanding – what you must know

a. The properties and characteristics of liquefied and other relevant gases
b. Personnel safety, vessel safety and environmental considerations related to the carriage of LNG
c. The regulations and guidelines related to the carriage of LNG at sea
d. The features of LNG ship design and safety systems, how and why they differ from other typical ship design and safety features and the differences they make to ship operations, ship handling and cargo storage
e. LNG propulsion system types, typical operating parameters and specific features and how they relate to the method of cargo management
f. The materials used on LNG ships, where they are used and why they are suitable for their purpose
g. Cargo tank filling capacities, limitations and associated features
h. Specific features and commercial implications, including vetting and other inspections, associated with LNG storage, containment, measurement, loading, discharging and cargo cycles
i. How different types of ship to shore interface processes and equipment might impact on vessel, mooring and cargo operations
j. Safe and efficient LNG ballast-handling practices
k. LNG-specific risk assessment requirements and processes
l. Individual areas of responsibility

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_2ENG_1a	1.1 (All)
E_2ENG_1b	1.4, 1.6 (All), 1.7.1
E_2ENG_1c	1.3 (All)
E_2ENG_1d	1.2 (All), 2.1(All), 3.12.1, 5.1 (All)
E_2ENG_1e	3.16 (All), 3.17.1, 3.17.2, 3.17.3, 3.17.5
E_2ENG_1f	1.5 (All)
E_2ENG_1g	3.10.1
E_2ENG_1h	3.11.1, 6.2.1
E_2ENG_1i	3.5.1, 3.5.2, 3.5.4, 3.5.5, 3.6, 4.5.1, 4.5.4
E_2ENG_1j	4.8.3, 4.10.4
E_2ENG_1k	1.8 (All)
E_2ENG_1l	1.9 (All)

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_COFF_2a	3.5 (All), 3.6, 3.7, 3.8 (All), 3.9(All)
D_COFF_2b	3.3 (All), 3.4 (All), 3.14 (All)
D_COFF_2c	1.9 (All)
D_COFF_2d	1.9.1
D_COFF_2e	1.3 (All), 3.8.1, 3.9.1
D_COFF_2f	1.11 (All)

UNIT D_COFF_3 PREPARE AND IMPLEMENT A DETAILED PLAN FOR THE ENTIRE CARGO CYCLE

Unit summary

What this unit is about

This unit defines the competence required to prepare and implement a detailed plan for the entire cargo cycle on board a Liquefied Natural Gas Carrier.

The stages of the cargo cycle and the planning requirements for each stage are identified. Issues, operational aspects and health and safety considerations which may impact on the plan are confirmed.

A detailed plan for each stage of the cargo cycle is produced, ensuring health and safety considerations are paramount. Individual responsibilities and the specific vessel and cargo operations risk assessment requirements and processes are confirmed.

The plan is implemented in line with agreed procedures, guidelines and health and safety practice

The entire cargo cycle from refit to refit is covered, and includes the following cargo cycle stages:

- Cleaning
- Drying
- Inerting
- Purging/gassing up
- Cool down
- Loading
- Loaded passage
- Discharge including heel out
- Ballast passage
- Warming up
- Inerting
- Aerating

Who this unit is for

This unit is for Chief Officers on board Liquefied Natural Gas Carriers.

UNIT D_COFF_3 PREPARE AND IMPLEMENT A DETAILED PLAN FOR THE ENTIRE CARGO CYCLE

Outcomes of effective performance – you must be able to do the following:

1. Identify the stages of the cargo cycle and the planning requirements for each stage
2. Confirm issues, operational aspects and health and safety considerations which may impact on the plan
3. Produce a detailed plan for each stage of the cargo cycle, ensuring health and safety considerations are paramount
4. Confirm with those involved in the planned operation that they understand their own responsibilities and the responsibilities of others where relevant
5. Implement the plan in line with agreed procedures, guidelines and health and safety practice

Knowledge and understanding – what you must know

a. Cargo cycle stages and what needs to be planned for each stage
b. The typical and usual issues and operational aspects that could have an impact on the plan
c. The health and safety risks and factors to consider for each of the cargo cycle stages and their potential impact on the entire cargo cycle
d. Organisational requirements for cargo cycle plans
e. Individual responsibilities for all aspects of the cargo cycle
f. Implementation procedures, guidelines and health and safety practice

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_COFF_3a D_COFF_3b	4 (All)
D_COFF_3c	1.6 (All), 1.7 (All), 1.8 (All)
D_COFF_3d	1.12
D_COFF_3e	1.9 (All)
D_COFF_3f	1.3 (All), 6.1.6

UNIT E_2ENG_3 ENSURE EFFECTIVENESS OF THE ENTIRE CARGO CYCLE

Outcomes of effective performance – what you must do

1. Identify all cargo cycle operational parameters and the equipment required, operating specifications, limits and maintenance requirements.
2. Confirm status of the equipment meets operating parameters and requirements.
3. Identify the function and conditions of cargo related spaces and confirm appropriate monitoring systems and required tests for cargo containment, cargo equipment and cargo related spaces.
4. Confirm individual responsibilities for maintaining, testing and inspecting cargo containment, cargo equipment and cargo related spaces and that they are operated in line with required parameters.
5. Determine and take an appropriate course of action where deviations from normal parameters of the cargo cycle are identified and inform the relevant personnel.
6. Ensure accurate and complete records are maintained.

Knowledge and understanding – what you must know

a. Operational parameters for each stage of the cargo cycle
b. Operational parameters, specifications, limits and maintenance requirements for cargo cycle equipment
c. Types of cargo related spaces, the functions they serve and what constitutes an appropriate condition for optimum effect
d. Monitoring systems, requirements and tests for cargo containment, cargo equipment and cargo related spaces
e. Individual areas of responsibility
f. Types of deviations that may arise, rectifying actions and who needs to be informed
g. Record keeping requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_2ENG_3a	4.1.1, 4.2.1, 4.3.1, 4.4.1, 4.5.1, 4.5.2, 4.5.4, 4.6.1, 4.7.1, 4.8.1, 4.8.3, 4.9.1, 4.10.1, 4.10.4, 4.11.1, 4.12.1, 4.13.1
E_2ENG_3b	2.17, 2.18, 2.19, 2.2, 2.3, 2.4, 3.5.1, 3.5.2, 3.5.4, 3.5.5
E_2ENG_3c	2.20.1
E_2ENG_3d	3.3 (All), 3.4 (All), 3.10.1, 3.11.1, 3.14 (All)
E_2ENG_3e	1.9 (All)
E_2ENG_3f	1.9.1, 3.3.3, 3.4.3, 5.7
E_2ENG_3g	1.11 (All)

UNIT E_2ENG_4 CONTROL THE OPERATION OF GAS-BURNING EQUIPMENT AND ASSOCIATED SYSTEMS.

Unit Summary

What this unit is about

This unit defines the competence required to control the operation of gas burning equipment and associated systems on Liquefied Natural Gas Carriers.

The fuel gas combustion equipment and machinery is operated within safe operating limits and defined parameters and the fuel gas is conditioned as required.

Adjustments are made to the plant as required to maintain specified voyage arrival and loading / delivery cargo conditions.

The gas burning equipment is maintained and tested as required, and non-standard operating conditions are identified and remedial action taken.

Who this unit is for

This unit is for Second Engineers on board Liquefied Natural Gas Carriers.

UNIT E_2ENG_4 CONTROL THE OPERATION OF GAS-BURNING EQUIPMENT AND ASSOCIATED SYSTEMS

*Outcomes of effective performance – **what you must do***

1. Operate fuel gas combustion equipment and machinery within safe operating limits and defined parameters.
2. Condition the fuel gas to meet design criteria of the particular plant regarding delivery pressure and temperature control.
3. Identify non-standard operating conditions from alarms and other relevant sources and take the appropriate remedial action in a timely and safe manner.
4. Make adjustments to the plant as required to maintain specified voyage arrival and loading / delivery cargo conditions.
5. Maintain and test, within relevant time scales, associated equipment, apparatus, alarm functions, and processes in accordance with applicable regulations, procedures, guidelines and safety practice.

*Knowledge and understanding – **what you must know***

a. Types, design and safe operation of fuel gas combustion equipment and machinery.
b. Fuel gas conditioning methods and systems, the most efficient use of each particular aspect, and when each should be used to best effect.
c. Typical plant parameters and limitations and how they will affect operations.
d. What constitutes a fault condition and the remedial action that may be required when such conditions are encountered.
e. Maintenance, testing and scheduling requirements.
f. Regulations, procedures, guidelines and safety practice.

UNIT D_MAST_8 DEVELOP UNDERSTANDING OF COMMERCIAL ASPECTS OF LNG TRADE AND TRANSPORTATION

Outcomes of effective performance – what you must do

1. Identify the basic terms and conditions in which LNG is bought and sold and its implication on vessel operations.
2. Identify the basic terms and conditions in which LNG is transported and its implication on vessel operations.

Knowledge and understanding – what you must know

a. Basic terms and conditions used in the LNG trade.
b. Principles of LNG measurement.
c. Basic LNG time charter types
d. Basic LNG time charter performance clauses
e. Economic implications of boil off/heel management

Relevant industry International organisations and bodies

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_MAST_8a	6.1.1
D_MAST_8b	6.1.2
D_MAST_8c	6.1.3
D_MAST_8d	6.1.4
D_MAST_8e	6.1.5
D_MAST_8f	6.1.6

CHIEF OFFICER

UNIT D_COFF_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Unit summary

What this unit is about

This unit defines the competence required to develop familiarisation and understanding of LNG transportation requirements.

The properties of liquefied and other relevant gases and their impact on safety and vessel operations are identified and determined.

The regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment are identified and their impact on cargo storage, transportation and containment is determined.

The complete cargo cycle is identified, and the cargo equipment required for each cargo cycle stage is identified including any specific features and issues which may arise in operation.

Individual responsibilities and the specific vessel and cargo operations risk assessment requirements and processes are confirmed.

Who this unit is for

This unit is for Chief Officers on board Liquefied Natural Gas Carriers.

UNIT E_2ENG_6 ENSURE INTEGRITY OF ELECTRICAL PLANT AND CONTROL SYSTEMS

Unit Summary

What this unit is about

This unit defines the competence required to control the maintenance and repair of marine electrical machinery and control systems on board Liquefied Natural Gas Carriers according to maintenance plans and instructions or as a result of an unacceptable variation.

Equipment and systems are isolated, work areas are confirmed as safe for work to proceed and permit to work and environmental issues and procedures implemented. Machinery and systems are restored to correct settings and work is completed and tested and final checks to ensure maintenance has been effective are carried out. Systems are de-isolated and returned to normal service.

The systems and equipment covered by this unit include, but are not limited to, the following systems, their components and specific features:

- Voltage Systems > 500 V
  - Equipment isolation
  - Earthing arrangements
  - Permit to work systems
- Voltage Systems < 500 V
  - Equipment isolation
  - Permit to work systems
- Electronic and pneumatic control systems
- Electrical equipment in hazardous areas – Ex i, Ex d, Ex p

Who this unit is for

This unit is for Second Engineers on board Liquefied Natural Gas Carriers.

Outcomes of effective performance – what you must do

1. Prepare a plan to maintain electrical plant and control systems and their components in accordance with established regulations, procedures, guidelines, safety practice, and environmental protection
2. Confirm that work areas, machinery and equipment are safe for work to proceed and comply with legislative requirements, codes of practice, isolation and earthing procedures, permit to work procedures and environmental concerns
3. Control the planned maintenance, checks and tests in accordance with established safety rules and regulations, manufacturers instructions and recognised practice
4. Ensure the integrity of electrical equipment in hazardous areas
5. Ensure that variances from the specification, plans and schedules are correctly identified and that effective corrective action is specified
6. Identify non-standard operating conditions from alarms and other relevant sources and take the appropriate remedial action in a timely and safe manner.
7. Ensure that the equipment or system is restored to the correct settings and specification using the appropriate repair or adjustment method
8. Control the de-isolation procedures to vessel standards, operational requirements and specification
9. Ensure that tests are carried out to verify that equipment and systems meet required performance after maintenance or repair
10. Ensure that documentation and records are completed accurately and to meet future requirements

Knowledge and understanding – what you must know

a. The regulations and guidelines related to the maintenance of electrical and control systems.
b. The safe isolation and earthing procedures applicable to the systems, including the permit to work and isolation systems
c. The types of electrical equipment which may be used in hazardous areas, and the operation and maintenance requirements
d. Operational parameters, specifications, limits and maintenance requirements for electrical and control systems and equipment
e. What constitutes a fault condition and the remedial action that may be required when such conditions are encountered.

f. The testing, adjustment and repair methods applicable to electrical and control systems and equipment
g. Record keeping requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_2ENG_6a	1.3.1, 1.3.2
E_2ENG_6b	3.13 (All)
E_2ENG_6c	3.12 (All)
E_2ENG_6d E_2ENG_6e E_2ENG_6f	2.7.3, 2.7.4, 2.8.3, 2.8.4, 2.9.3, 2.9.4, 2.18, 3.3.4, 3.4.2, 3.4.3, 3.5.6, 3.5.7, 3.10.2, 3.11.3, 3.15, 3.17.6, 3.17.7, 5.8, 5.15
E_2ENG_6g	1.11 (All)

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_MAST_5a	1.3 (All), 5.1.1, 5.2 (All), 5.3, 5.4, 5.5, 5.6, 5.7, 5.8.1
D_MAST_5b	1.8 (All)
D_MAST_5c	1.10 (All)
D_MAST_5d	1.9 (All)
D_MAST_5e	1.12

UNIT D_MAST_6 PLAN FOR AND MANAGE CARGO OPERATIONS UNDER EMERGENCY CONDITIONS

Unit Summary

What this unit is about

This unit defines the competence required to ensure the effectiveness of cargo operations on Liquefied Natural Gas Carriers under emergency conditions.

The type, nature and scale of the emergency condition is determined, the options for dealing with the condition are evaluated, risk assessments are carried out and a plan to deal with the situation formulated in conjunction with other senior officers and superintendents.

Accurate and clear instructions are given to put the determined plan into operation. The effects of the plan are monitored and adjustments made as required. The plan is subsequently reviewed to identify lessons learnt and provide feedback.

The emergency conditions covered by this unit include, but are not limited to, the following situations:

- Loss of Primary Barrier
- Ballast tank leakage into containment space
- Nitrogen supply failure
- Jettisoning cargo
- Overfilling a cargo tank
- Failure of integrated automation system
- Uncontrolled release of cargo
- Loss of cargo pipeline containment

Who this unit is for

This unit is for Masters on board Liquefied Natural Gas Carriers.

UNIT D_MAST_6 PLAN FOR AND MANAGE CARGO OPERATIONS UNDER EMERGENCY CONDITIONS

Outcomes of effective performance – what you must do

1. Determine the type, nature and scale of the emergency from alarms and relevant sources
2. Identify the options, carry out risk assessments and determine the appropriate course of action to deal safely and in a controlled manner with the emergency
3. Provide accurate and clear instructions and information to relevant people to deal with the emergency
4. Monitor the actions being carried out, confirm the desired effect and determine necessary corrective actions where required.
5. Confirm the emergency condition is being managed and the situation mitigated.
6. Provide accurate and complete records.

Knowledge and understanding – what you must know

a. Types of emergency conditions and applicable regulations, procedures, guidelines and safety practice for dealing with them
b. How to carry out risk assessments
c. How to formulate, adjust and implement contingency plans
d. Individual levels of responsibility and the importance of checking and confirming understanding of instructions given
e. The importance of reviewing the plan and course of action taken

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_MAST_6a	1.3 (All), 5.1.2, 5.9, 5.10, 5.11, 5.12, 5.13 (All), 5.14, 5.15, 5.16
D_MAST_6b	1.8 (All)
D_MAST_6c	1.10 (All)
D_MAST_6d	1.9 (All)
D_MAST_6e	1.12

UNIT E_JENG_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Unit summary

What this unit is about

This unit defines the competence required to manage the operation, testing and inspection of safety systems and equipment on board Liquefied Natural Gas Carriers.

The equipment parameters are identified, along with maintenance and testing requirements. The individual responsibilities for equipment are confirmed, safety systems and equipment are managed and operated as required in line with regulations, procedures, guidelines and safety practice and records are kept.

The systems and equipment covered by this unit include, but is not limited to the following systems and specific features:

- Emergency shut down system
  - Ship/shore link
  - Fusible plugs/sensors
  - Cargo machinery space flooding system activation
  - Emergency release system
- Water curtain and deck spray
  - Rinsing/testing etc
- Gas detection systems – fixed and portable
  - Proof of functionality
- Fixed dry powder

Who this unit is for

This unit is for Third and Fourth Engineers on board Liquefied Natural Gas Carriers.

UNIT E_JENG_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Outcomes of effective performance – what you must do

1. Identify the safety systems and equipment required for carriage of LNG, its parameters, operating specifications and limits and maintenance requirements.
2. Confirm that the status of the safety systems and equipment meets operating parameters and requirements.
3. Confirm appropriate monitoring systems and required tests for safety systems and equipment
4. Confirm individual responsibilities for maintaining, testing and inspecting safety systems and equipment
5. Verify the results of maintenance, testing and inspection of safety systems and equipment and where they are not in line with required parameters, determine the relevant action and/or inform the appropriate person.
6. Operate safety systems and equipment as required in line with regulations, procedures, guidelines and safety practice
7. Provide accurate and complete records.

Knowledge and understanding – what you must know

a. Operational parameters, specifications, limits and maintenance requirements for LNG safety systems and equipment
b. Monitoring systems, requirements and tests for safety systems and equipment
c. Individual areas of responsibility
d. The actions to take with non-compliance of safety systems and equipment and who needs to be informed
e. How to operate safety systems and equipment, and the related regulations, procedures, guidelines and safety practice
f. Record keeping requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_JENG_2a	3.5.1, 3.8.1, 3.9.1
E_JENG_2b	3.3.1, 3.3.3, 3.4.1, 3.4.3, 3.14.1
E_JENG_2c	1.9.1
E_JENG_2d	
E_JENG_2e	1.3.1, 1.3.3
E_JENG_2f	1.11.1

UNIT E_JENG_3 OPERATE GAS-BURNING EQUIPMENT AND ASSOCIATED SYSTEMS

Unit Summary

What this unit is about

This unit defines the competence required to control the operation of gas burning equipment and associated systems on Liquefied Natural Gas Carriers.

The fuel gas combustion equipment and machinery is operated within safe operating limits and defined parameters and the fuel gas is conditioned as required.

Adjustments are made to the plant as required to maintain specified voyage arrival and loading / delivery cargo conditions.

The gas burning equipment is maintained and tested as required, and non-standard operating conditions are identified and remedial action taken.

Who this unit is for

This unit is for Third and Fourth Engineers on board Liquefied Natural Gas Carriers.

UNIT D_MAST_3 PREPARE AND IMPLEMENT A DETAILED PLAN FOR THE ENTIRE CARGO CYCLE

Unit summary

What this unit is about

This unit defines the competence required to prepare and implement a detailed plan for the entire cargo cycle on board a Liquefied Natural Gas Carrier.

The stages of the cargo cycle and the planning requirements for each stage are identified. Issues, operational aspects and health and safety considerations which may impact on the plan are confirmed.

A detailed plan for each stage of the cargo cycle is produced, ensuring health and safety considerations are paramount. Individual responsibilities and the specific vessel and cargo operations risk assessment requirements and processes are confirmed.

The plan is implemented in line with agreed procedures, guidelines and health and safety practice

The entire cargo cycle from refit to refit is covered, and includes the following cargo cycle stages:

- Cleaning
- Drying
- Inerting
- Purging/gassing up
- Cool down
- Loading
- Loaded passage
- Discharge including heel out
- Ballast passage
- Warming up
- Inerting
- Aerating

Who this unit is for

This unit is for Masters on board Liquefied Natural Gas Carriers.

UNIT D_MAST_3 PREPARE AND IMPLEMENT A DETAILED PLAN FOR THE ENTIRE CARGO CYCLE

Outcomes of effective performance – you must be able to do the following:

1. Identify the stages of the cargo cycle and the planning requirements for each stage
2. Confirm issues, operational aspects and health and safety considerations which may impact on the plan
3. Produce a detailed plan for each stage of the cargo cycle, ensuring health and safety considerations are paramount
4. Confirm with those involved in the planned operation that they understand their own responsibilities and the responsibilities of others where relevant
5. Implement the plan in line with agreed procedures, guidelines and health and safety practice

Knowledge and understanding – what you must know

a. Cargo cycle stages and what needs to be planned for each stage
b. The typical and usual issues and operational aspects that could have an impact on the plan
c. The health and safety risks and factors to consider for each of the cargo cycle stages and their potential impact on the entire cargo cycle
d. Organisational requirements for cargo cycle plans
e. Individual responsibilities for all aspects of the cargo cycle
f. Implementation procedures, guidelines and health and safety practice

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
D_MAST_3a D_MAST_3b	4 (All)
D_MAST_3c	1.6 (All), 1.7 (All), 1.8 (All)
D_MAST_3d	1.12
D_MAST_3e	1.9 (All)
D_MAST_3f	1.3 (All), 6.1.6

UNIT D_MAST_4 MONITOR AND REVIEW CARGO CYCLE OPERATIONS

Unit summary

What this unit is about

This unit defines the competence required to monitor and review cargo cycle operations for the entire cargo cycle on board a Liquefied Natural Gas Carrier.

The cargo cycle operations are carried out and monitored at relevant times and critical points. Appropriate changes to the plan are identified where its execution shows shortfalls or problems or raises issues during implementation and appropriate action is taken.

Clear and accurate instructions are given as required and to implement identified changes. The operation is reviewed and evaluated and appropriate feedback given.

Who this unit is for

This unit is for Masters on board Liquefied Natural Gas Carriers.

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_JENG_4a	1.3.1, 1.3.3, 3.17.7
E_JENG_4b	1.9.1

UNIT E_JENG_5 OPERATE ELECTRICAL PLANT AND CONTROL SYSTEMS

Unit Summary

What this unit is about

This unit defines the competence required to operate marine electrical machinery and control systems on board Liquefied Natural Gas Carriers according to instructions or as a result of an unacceptable variation.

The marine electrical machinery and control systems are operated within safe operating limits and defined parameters.

Adjustments are made to the marine electrical machinery and control systems as required.

Who this unit is for

This unit is for Third and Fourth Engineers on board Liquefied Natural Gas Carriers.

UNIT E_JENG_5 OPERATE ELECTRICAL PLANT AND CONTROL SYSTEMS

Outcomes of effective performance – what you must do

1. Operate electrical machinery and control systems within safe operating limits and defined parameters.
2. Identify non-standard operating conditions from alarms and other relevant sources and inform the appropriate person in a timely and safe manner.
3. Make adjustments according to instructions received
4. Assist with maintenance and testing, within relevant time scales, in accordance with organisational procedures.

Knowledge and understanding – what you must know

a. Types and safe operation of electrical machinery and control systems, typical parameters and limitations and how they will affect operations.
b. What constitutes a fault condition and the importance of informing the appropriate person.
c. Maintenance and testing requirements.
d. Permit to work and isolation procedures and requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_JENG_5a E_JENG_5d	3.12.1, 3.13.1, 3.14.1, 3.15
E_JENG_5b	1.9.1
E_JENG_5c	1.11.1

5 Maintain cargo equipment
6 Gas burning
7 Propulsion plant non-standard ops
8 Electrical plant and control systems

2nd Eng **106**

1 Familiarisation
2 Safety Equipment
3 Normal cargo cycle
4 Gas burning
5 Propulsion plant non-standard ops
6 Electrical plant and control systems

3rd Eng/4th Eng **126**

1 Familiarisation
2 Safety Equipment
3 Gas burning
4 Propulsion plant non-standard ops
5 Electrical plant and control systems

Electrician **142**

1 Familiarisation
2 Safety Equipment
3 Electrical plant and control systems

MASTER

UNIT D_MAST_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Unit summary

What this unit is about

This unit defines the competence required to develop familiarisation and understanding of LNG transportation requirements.

The properties of liquefied and other relevant gases and their impact on safety and vessel operations are identified and determined.

The regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment are identified and their impact on cargo storage, transportation and containment is determined.

The complete cargo cycle is identified, and the cargo equipment required for each cargo cycle stage is identified including any specific features and issues which may arise in operation.

Individual responsibilities and the specific vessel and cargo operations risk assessment requirements and processes are confirmed.

Who this unit is for

This unit is for Masters on board Liquefied Natural Gas Carriers.

UNIT D_MAST_1 DEVELOP FAMILIARISATION AND UNDERSTANDING OF LNG TRANSPORTATION REQUIREMENTS

Outcomes of effective performance - You must be able to do the following:

1. Identify the properties and characteristics of liquefied and other relevant gases and determine their impact on safety and vessel operations
2. Identify the regulations and guidelines, vessel designs, characteristics, propulsion systems, materials and cargo related equipment and determine the impact on cargo storage, transportation and containment
3. Determine specific loading and discharging features and cargo cycles and confirm individual responsibilities for those involved
4. Identify the ship to shore interface and equipment and determine any issues they might raise during vessel and cargo operations
5. Confirm the specific vessel and cargo operations risk assessment requirements and processes for those involved

Knowledge and understanding – what you must know

a. The properties and characteristics of liquefied and other relevant gases
b. Personnel safety, vessel safety and environmental considerations related to the carriage of LNG
c. The regulations and guidelines related to the carriage of LNG at sea
d. The features of LNG ship design and safety systems, how and why they differ from other typical ship design and safety features and the differences they make to ship operations, ship handling and cargo storage
e. LNG propulsion system types, typical operating parameters and specific features and how they relate to the method of cargo management
f. The materials used on LNG ships, where they are used and why they are suitable for their purpose
g. Cargo tank filling capacities, limitations and associated features
h. Specific features and commercial implications, including vetting and other inspections, associated with LNG storage, containment, measurement, loading, discharging and cargo cycles
i. How different types of ship to shore interface processes and equipment might impact on vessel, mooring and cargo operations
j. Safe and efficient LNG ballast-handling practices
k. LNG-specific risk assessment requirements and processes
l. Individual areas of responsibility

UNIT E_ELECT_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Unit summary

What this unit is about

This unit defines the competence required to manage the operation, testing and inspection of safety systems and equipment on board Liquefied Natural Gas Carriers.

The equipment parameters are identified, along with maintenance and testing requirements. The individual responsibilities for equipment are confirmed, safety systems and equipment are managed and operated as required in line with regulations, procedures, guidelines and safety practice and records are kept.

The systems and equipment covered by this unit include, but is not limited to the following systems and specific features:

- Emergency shut down system
  - Ship/shore link
  - Fusible plugs/sensors
  - Cargo machinery space flooding system activation
  - Emergency release system
- Water curtain and deck spray
  - Rinsing/testing etc
- Gas detection systems – fixed and portable
  - Proof of functionality
- Fixed dry powder

Who this unit is for

This unit is for Electrical Engineers on board Liquefied Natural Gas Carriers.

UNIT E_ELECT_2 MANAGE AND OPERATE SAFETY SYSTEMS AND EQUIPMENT

Outcomes of effective performance – what you must do

1. Identify the safety systems and equipment required for carriage of LNG, its parameters, operating specifications and limits and maintenance requirements.
2. Confirm that the status of the safety systems and equipment meets operating parameters and requirements.
3. Confirm appropriate monitoring systems and required tests for safety systems and equipment
4. Confirm individual responsibilities for maintaining, testing and inspecting safety systems and equipment
5. Verify the results of maintenance, testing and inspection of safety systems and equipment and where they are not in line with required parameters, determine the relevant action and/or inform the appropriate person.
6. Operate safety systems and equipment as required in line with regulations, procedures, guidelines and safety practice
7. Provide accurate and complete records.

Knowledge and understanding – what you must know

a. Operational parameters, specifications, limits and maintenance requirements for LNG safety systems and equipment
b. Monitoring systems, requirements and tests for safety systems and equipment
c. Individual areas of responsibility
d. The actions to take with non-compliance of safety systems and equipment and who needs to be informed
e. How to operate safety systems and equipment, and the related regulations, procedures, guidelines and safety practice
f. Record keeping requirements

Underpinning Knowledge

The underpinning knowledge document sections as detailed below describe the detailed knowledge document sections relating to the above knowledge statements:

Knowledge Statement	Underpinning knowledge sections
E_ELECT_2a	3.5.1, 3.5.6, 3.5.7, 3.8.1, 3.9.1
E_ELECT_2b	3.3.1, 3.3.3, 3.3.4, 3.4.1, 3.4.3, 3.14 (All)
E_ELECT_2c	1.9.1
E_ELECT_2d	
E_ELECT_2e	1.3.1, 1.3.3
E_ELECT_2f	1.11.1

UNIT E_ELECT_3 CONTROL, MAINTAIN AND REPAIR ELECTRICAL PLANT, CONTROL AND INSTRUMENTATION SYSTEMS

Unit Summary

What this unit is about

This unit defines the competence required to control, maintain and repair marine electrical machinery control and instrumentation systems on board Liquefied Natural Gas Carriers according to maintenance plans and instructions or as a result of an unacceptable variation.

Equipment and systems are isolated, work areas are confirmed as safe for work to proceed and permit to work and environmental issues and procedures implemented. Machinery and systems are restored to correct settings and work is completed and tested and final checks to ensure maintenance has been effective are carried out. Systems are de-isolated and returned to normal service.

The systems and equipment covered by this unit include, but are not limited to, the following systems, their components and specific features:

- Electrical Systems > 500 V
  - Switchgear
  - Equipment isolation
  - Earthing arrangements
  - Permit to work systems
- Electrical Systems < 500 V
  - Equipment isolation
  - Permit to work systems
- Electronic, optical and pneumatic control systems
- Electrical equipment in hazardous areas – Ex i, Ex d, Ex p

Who this unit is for

This unit is for Electrical Engineers on board Liquefied Natural Gas Carriers.