The Software Package

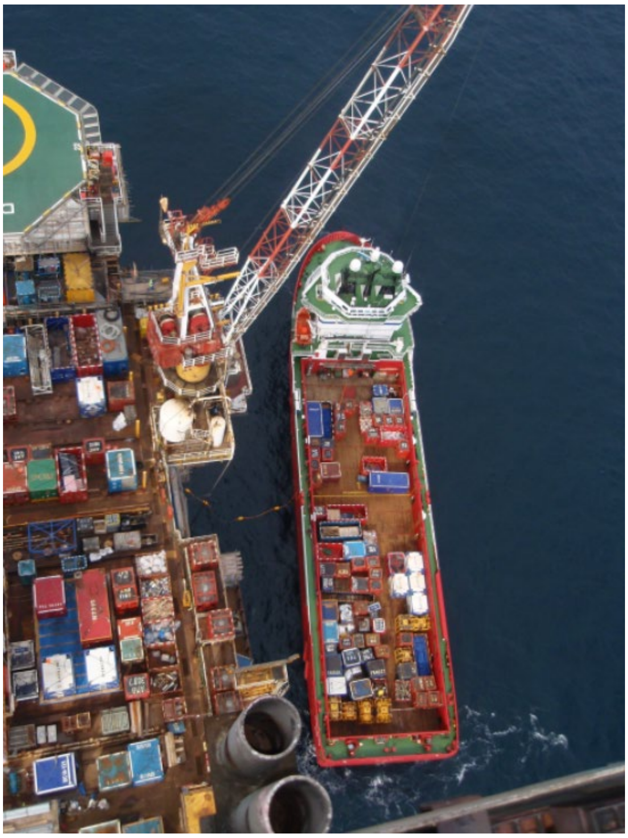
Marine Training Software
Part 12

UNITEST Marine Training Software Part 12 is the software package consisting of several independent educational modules.

The following modules are included:

1. Dynamic Positioning System – Introduction.
2. Ships High Voltage System – Introduction.
3. LNG as a fuel for sea-going commercial vessels - Introduction.

1. Dynamic Positioning System – Introduction



CBT – Computer Based Training, Dynamic Positioning System

This module of the computer based course presents fundamental aspects related to the marine dynamic positioning systems. It covers several chapters outlined below:

- DP System Definitions
- DP System Philosophy
- DP Vessels Activities
- DP Vessels in the Marine Environment
- Overview of DP System Components
- Operations
- Assessment

The explained concepts and functions of the DP System enable cadets and students to acquire basic knowledge concerning the general principles of Dynamic Positioning operation.

The course module concludes with an assessment, verifying the acquired knowledge. The result of this assessment can be stored in the computer's memory or printed. The test is considered passed when the participant achieves more than 60% correct answers.

DP System Definitions

The first chapter of the course includes an explanation of basic concepts related to Dynamic Positioning processes. Some examples of these concepts are:

- DP Vessel – Dynamically positioned vessel (DP vessel) means a vessel or unit that automatically maintains its position (fixed location or predetermined track) solely by a thruster force
- DP System – Dynamic positioning system (DP system) means the complete installation necessary for dynamic positioning of a vessel, consisting of the following subsystems:
  - Propulsion system,
  - Thruster system,
  - DP control system.

DP System Philosophy

The second chapter explains the principles of the DP system. An example is provided below:

- DP class 1 – for equipment Class 1, loss of a position may occur in the event of a single fault
- DP class 2 – for equipment Class 2, loss of a position is not to occur in the event of a single fault in any active component or system ….

DP Vessels Activities

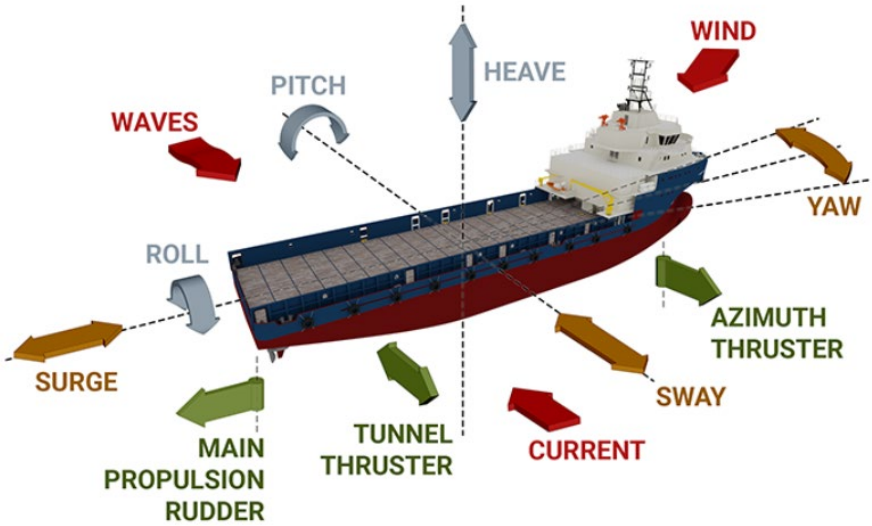
The next chapter of the course shortly explain wide range of activities for the offshore oil and gas industry, offshore wind farm industry and others. Some of the different type of DP vessels are:

- Diving support vessels
- Pipelay vessels
- Crane vessels …

DP Vessel in the Marine Environment

The fourth chapter places significant emphasis on discussing the impact of the marine environment on a DP vessel. The effects on the ship by external forces and its own propulsion cause the movement of the ship around six degrees of freedom.

The influence of the marine environment on a DP vessel and its motion around six degrees of freedom is presented in the diagram below:



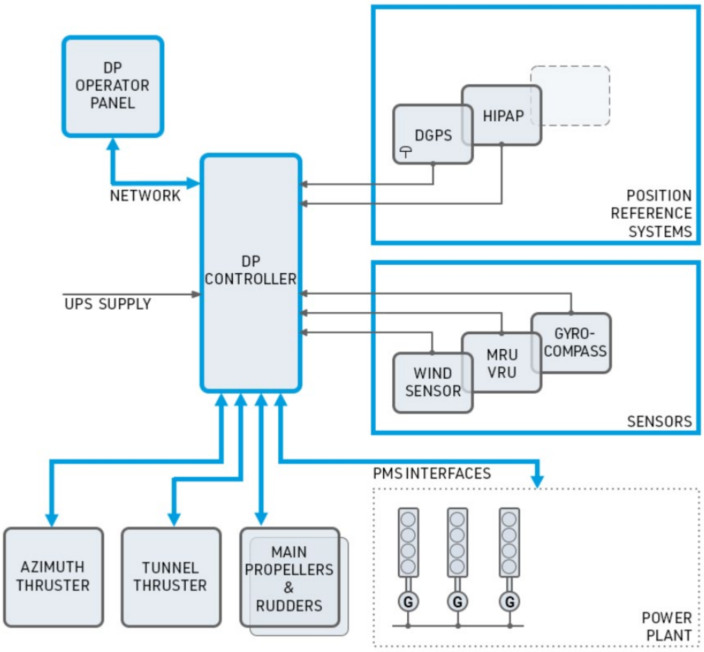
Overview of the DP System Components

The next chapter introduces the components of the DP system and explains their functions. Based on the definition of the DP System, we can list its main elements:

- Power System
- Thruster System
- DP Control System

Thruster components is presented on the diagram below:

The main components of the DP Control System (DP Vessel Class 1) are presented on the diagram below:



An example of a sensor that is a component of the DP Control System is the wind speed and direction sensor, depicted in the photo below:

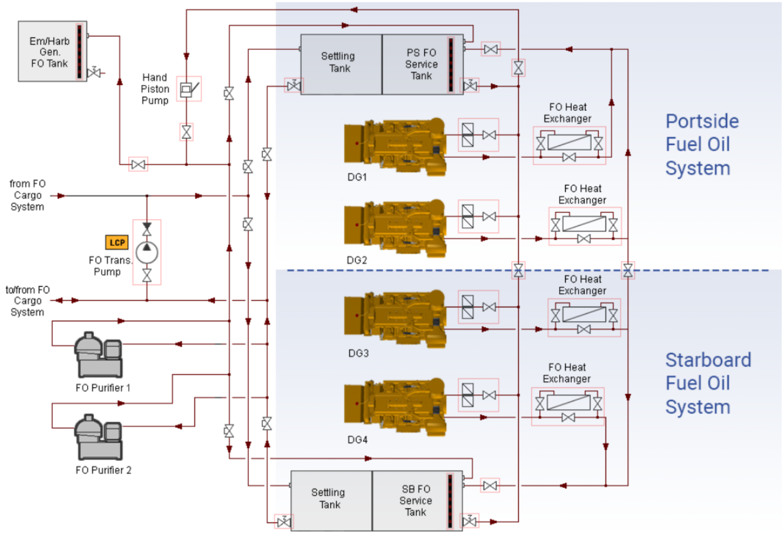
Operations

To demonstrate that all systems related to the operation of the DP system are ready to perform the entrusted task, appropriate tests should be carried out and documentation prepared. That information are included in this chapter.

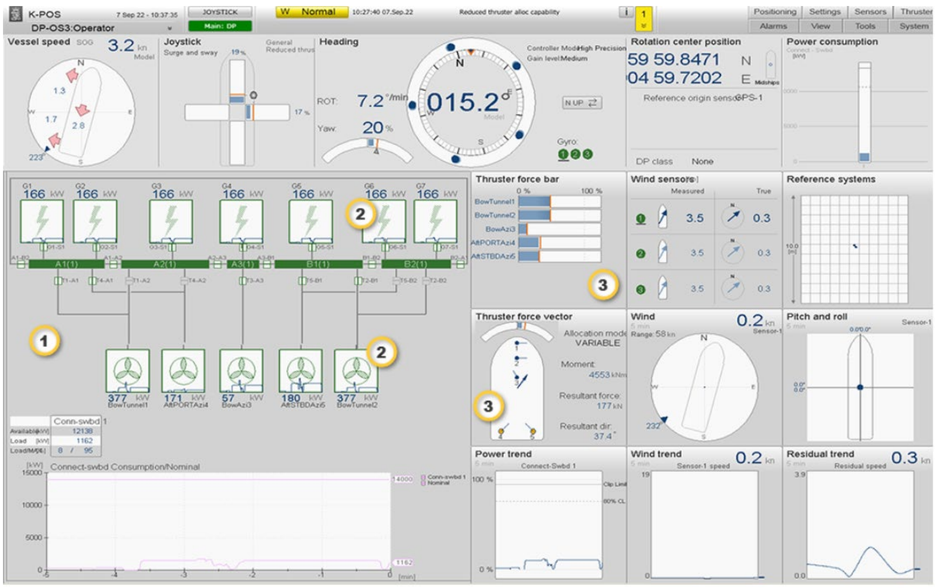
Rules for classification of ships, redundant propulsion (RP) – are listed as an example for Fuel System:

- There shall be at least two service tanks, which shall serve dedicated sub-systems. Crossover facilities may be arranged, but shall be kept closed in normal operation
- For Redundant Propulsion and Separate (RPS), the service tanks shall be installed one in each of the separate engine rooms …

Fuel system is presented on the diagram below:



DP Operator – DP System Visualization is presented on the diagram below:



An example of DP System Interface (K-Pos DP developed by Kongsberg Maritime)

Assessment

Assessment is the last section of the Computer Based Training (CBT).

After completing the quiz, the student can review the quiz, allowing them to verify the knowledge acquired.

2. Ships High Voltage System – Introduction

CBT – Computer Based Training, Ships High Voltage System

This module of the computer based course presents fundamental aspects related to the marine high voltage installations. It covers several chapters outlined below:

- Introduction to the ships High Voltage Installations
- High Voltage Installation
- Safety on board the vessel with HV installation
- Assessment

The explained concepts and functionality of the high voltage marine installation enable cadets and students to acquire basic knowledge concerning the general principles of the ship's electrical power system. Special safety aspects are highlighted in this course.

The course module concludes with an assessment, verifying the acquired knowledge. The result of this assessment can be stored in the computer's memory or printed. The test is considered passed when the participant achieves more than 60% correct answers.

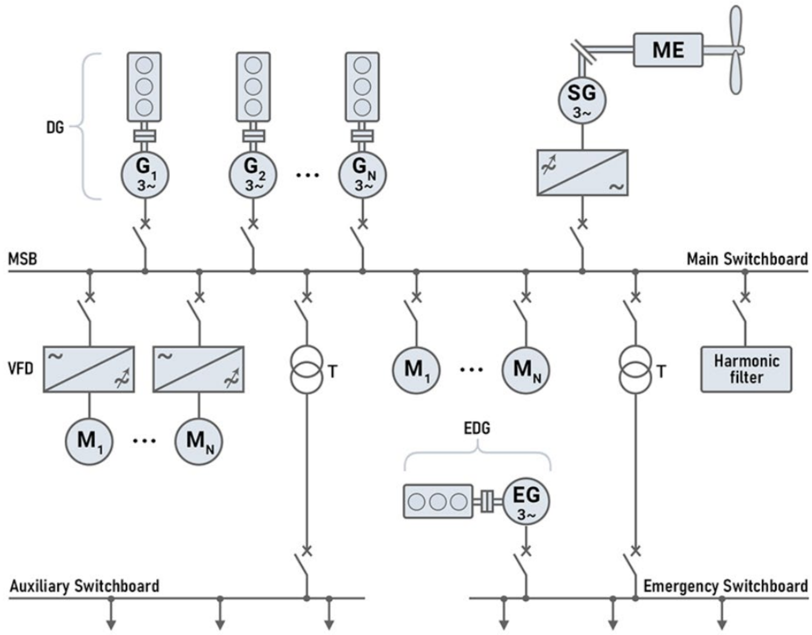
Introduction to the ships High Voltage Installations

It is required directly by the provisions of the STCW convention, that marine engine room personnel at the management and operational level should demonstrate knowledge and understanding of the issues related to the ship’s high voltage system.

This course is intended for representatives of the management and operational level in the ship's engine room department such as - for example:

- Chief Engineer
- Second Engineer
- Electro – Technical Officer …

The scope of this training focuses of the ship's electric power system and its components. The generic diagram of the ship's power system is presented below:



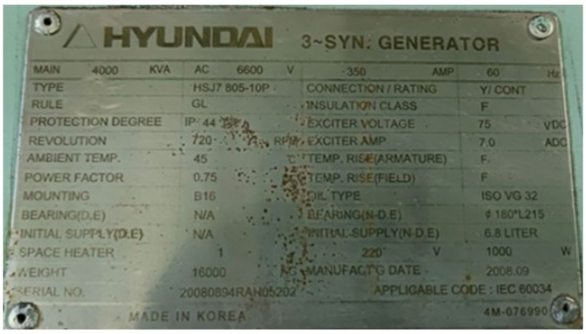
Some of the main specific characteristics of the onboard power system are explained in this course, such us:

- The limited power generation plant
- Subsystems of the different voltage levels e.g. 6 600 V, 440 V and 230 V
- The significant value of some consumer loads in comparison to the total installed generators capacity …

The comparison of the power of a single generator in relation to the power of the Bow Thruster is shown in the drawings below:

Generator's name plate

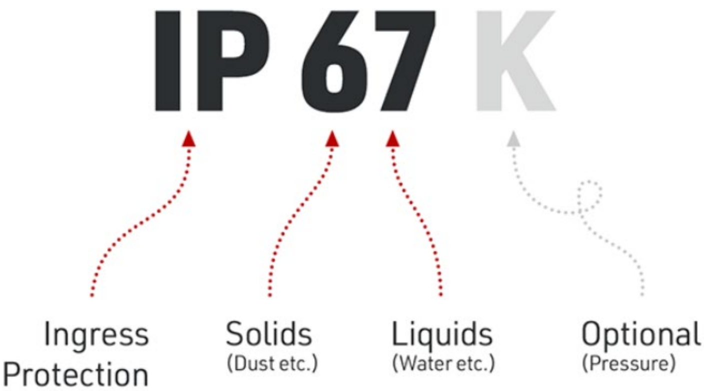
Apparent power output: 4 000 kVA
Voltage: 6 600 V, 60 Hz
Weight: 16 000 kg



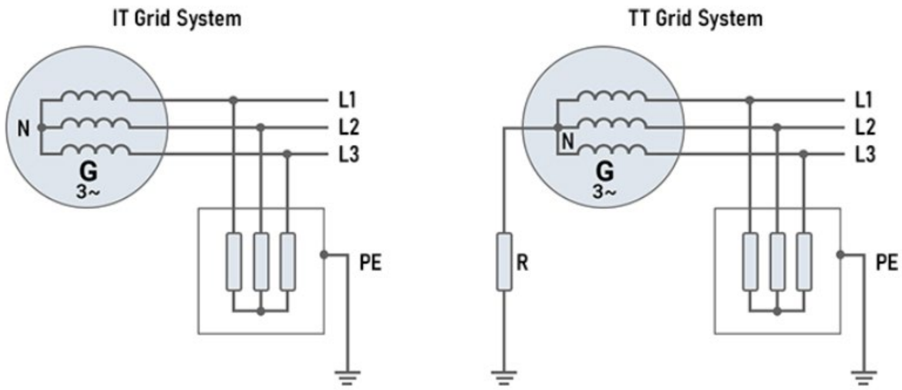
Bow thruster motor and its name plate

Power output: 3 000 kW
Supply voltage: 6 600 V, 60 Hz
Weight: 9 000 kg

High voltage installations on marine vessels require careful consideration of the enclosures of electrical devices; hence, this course covers aspects of IP (Ingress Protection).



Marine AC (Alternating Current) power distribution systems (grid system) may be configured as follows:



N - Neutral Point, **PE** - Protective Earth, **R** - Grounding Resistor

High Voltage Installation

Issues with the construction of low-voltage, high-power ship installations and the benefits of implementing High Voltage on ships are described in this chapter.

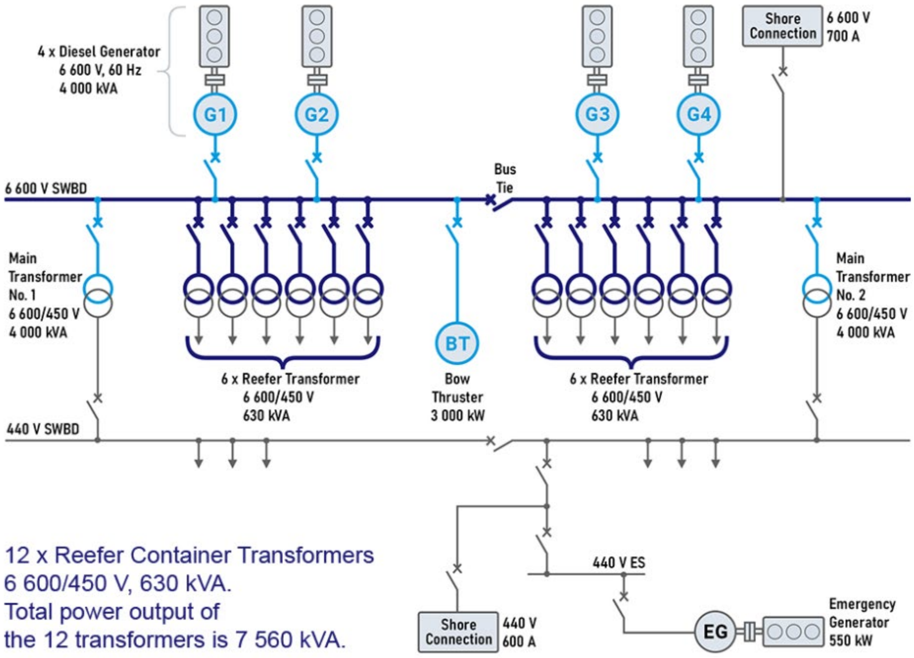
> **The high voltage installation means that the ship's electric power system includes elements of generation, distribution and consumption of the electric energy with a voltage exceeding 1 000 V.**

The following typical AC voltages in a vessel’s power systems are used:

- 3 300 V 60 Hz
- 6 600 V 60 Hz
- 11 000 V 60 Hz
- 20 000 V 60 Hz *

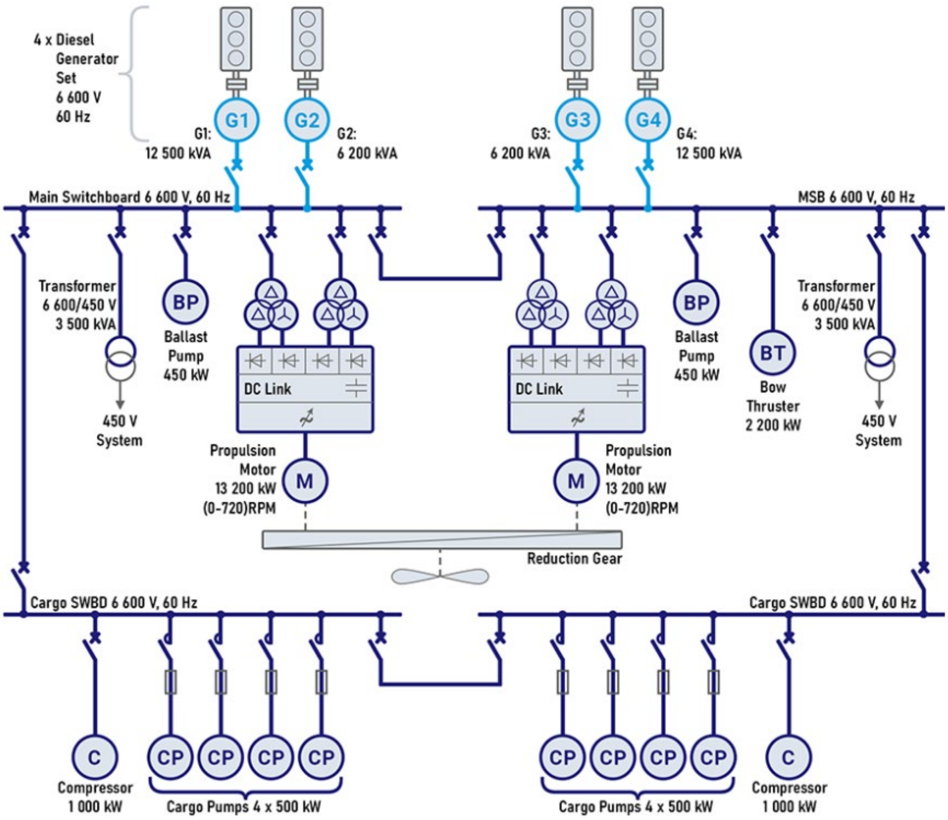
** Comprehensive explanation of the application possibilities of a voltage of 20 000 V on ships elucidates the material covered in the course.*

The following slide present the example of high voltage (HV) electrical installation and their components:



In this chapter, students can familiarize themselves with the details of the construction of High Voltage installation components. The assemblies of power generators and shore connection switchboards are shown in the picture below:

Another example of a High Voltage installation on a ship is presented below and discussed in this CBT chapter, the LNG tanker installation:



During the course, participants also familiarize themselves with the HV installation of a passenger ship, with a particular focus on the propulsion system.

Safety on board the vessel with HV installation

Safety culture and the 'zero incident' philosophy will be discussed in this chapter.

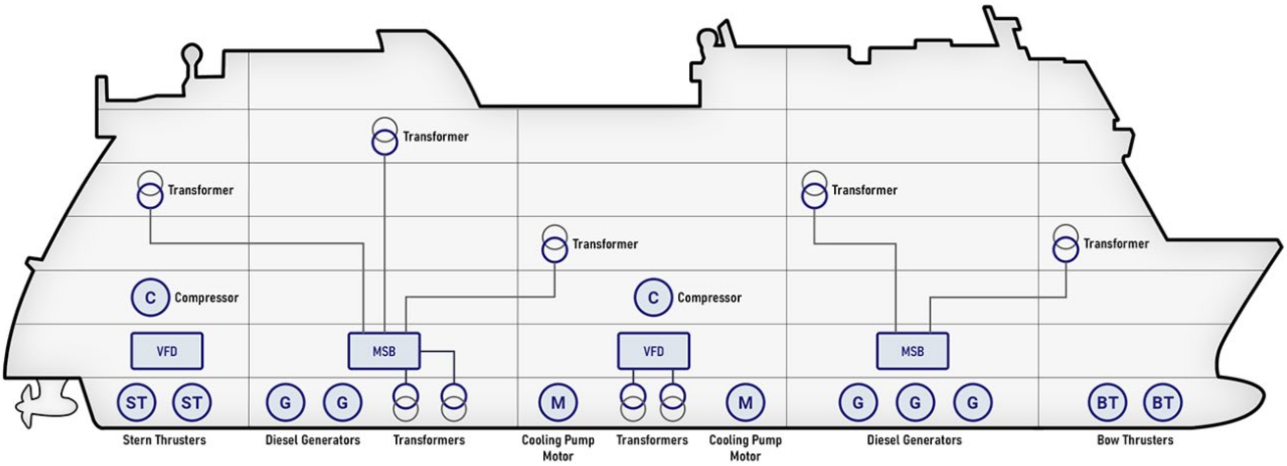
The specificity of the threats resulting from the high voltage installation installed on the ship requires the crew to meet the highest safety standards.

In addition, the safety of the ship's crew is secured by the requirements of the SOLAS convention.

SOLAS Convention,
Part D - Electrical Installations:

Regulation 45 - Precautions against shock, fire and other hazards of electrical origin

In this chapter, students familiarize themselves with the hazards associated with an extensive HV installation on a ship. Additionally, aspects related to the safe operation of electrical equipment are discussed, with a particular emphasis on the use of personal protective equipment.



Continuing the discussion of safety aspects related to working on a ship with an HV installation, we address and explain topics such as 'lock out, tag out' and interlocking key systems.

Three steps of trapped key interlocking.

Assessment

Assessment is the last section of the Computer Based Training (CBT).

After completing the quiz, the student can review the quiz, allowing them to verify the knowledge acquired.

3. LNG as a fuel for sea-going commercial vessels – Introduction

CBT – Computer Based Training, LNG as a fuel for sea-going commercial vessels - Introduction

This module of the computer based course presents fundamental aspects related to the LNG as a fuel. Specifically, we will focus on LNG as fuel for merchant marine vessels. We will not be dealing with the transportation of LNG itself using tankers.

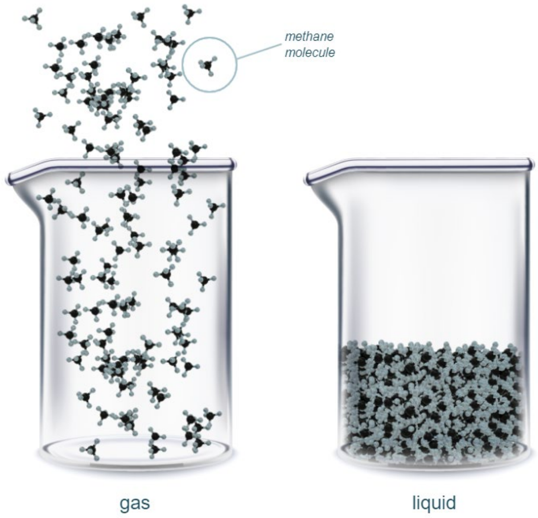
It covers several chapters outlined below:

- LNG Properties
- LNG on board – safety aspects
- LNG as the ship's main and auxiliary engines fuel
- LNG Bunkering
- Assessment

The explained concepts and safety aspects allow cadets and students to gain basic knowledge regarding the general principles of LNG used as fuel.

LNG Properties

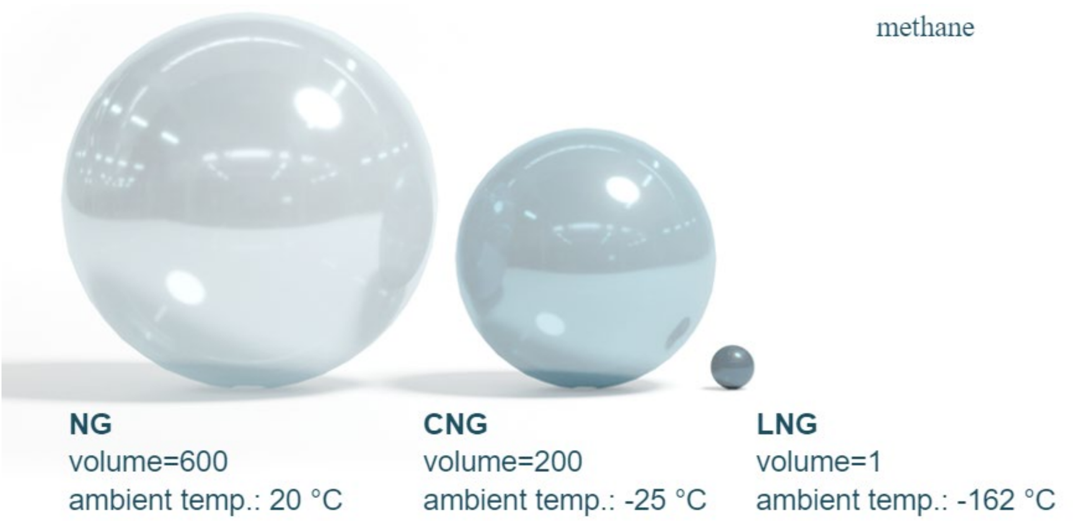
The first chapter of this course includes explanations of fundamental concepts related to liquefied natural gas - LNG. We discuss what LNG is. We present the distinctive features of methane and its properties.



In this chapter, participants learn about the characteristics and properties of natural gas, such as:

- Natural Gas is **NON-TOXIC**
- Natural Gas is **COLORLESS**
- Natural Gas is **ODORLESS**
- Natural Gas is **LIGHTER THAN AIR** …

We also learn about the significance of gas liquefaction.



At the end of the first chapter, students review the key information acquired up to this point.

LNG does not burn.
It has to evaporate first.

LNG on board – safety aspects

In the second chapter, we explain aspects related to the safety of the crew and the ship with LNG on board. Students learn basic rules, concepts, and IMO regulations.

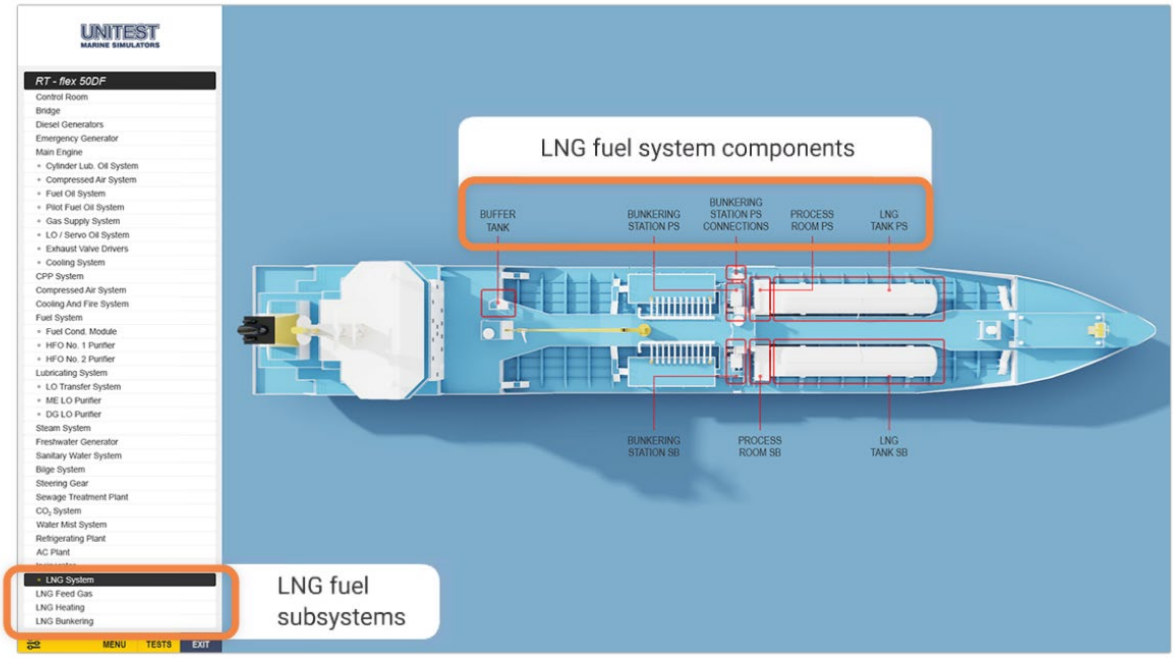
Maritime safety requirements related to the presence of LNG on sea-going vessels are based on regulations such as:

- SOLAS
- IMO IGC Code
- IMO IGF Code … *

** The detailed list of safety requirements is included in the course material.*

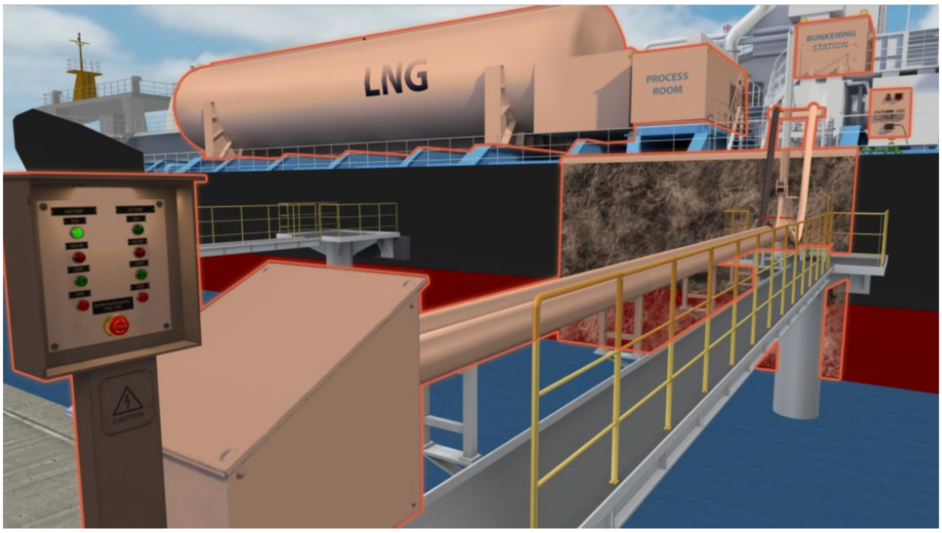
The basic components of the Dual Fuel system, regulated by the IMO IGF Code, are presented in the diagram below:

The IGF code targets presented below components of the DF (Dual Fuel) systems on board a ship.



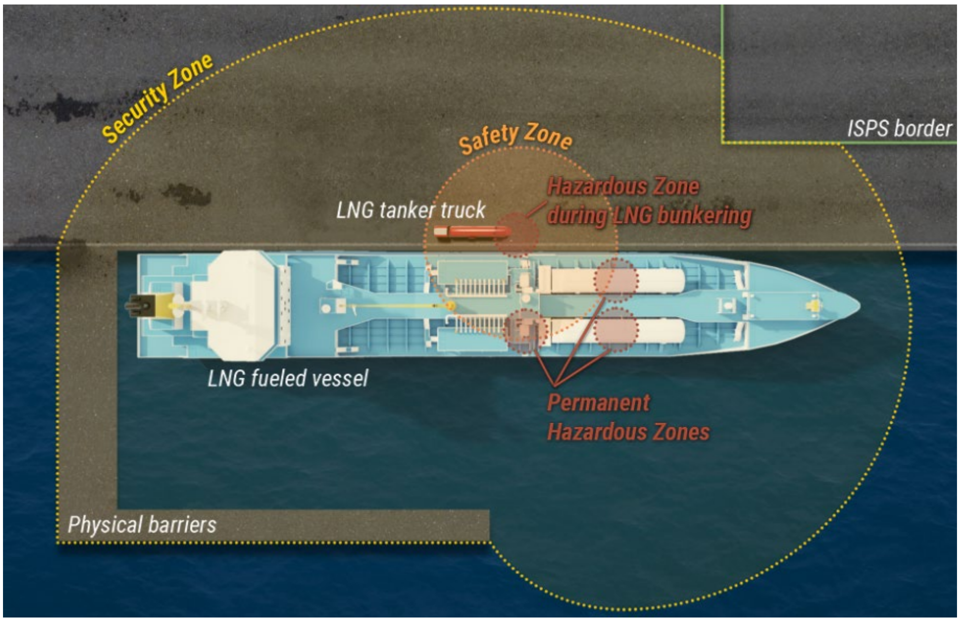
All regulations also apply to the safety of LNG handling activities such as:

- LNG fuel bunkering from a shore
- LNG fuel bunkering from a truck
- LNG fuel bunkering from a ship



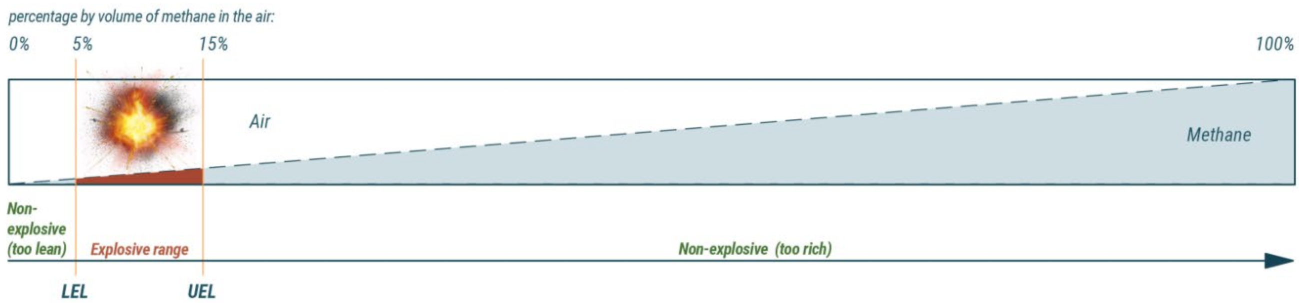
Students learn about concepts such as:

- Safety Zones
- Security Zones



The next concepts that students will encounter are for example:

- Low Explosive Limit – LEL
- Upper Explosive Limit - UEL



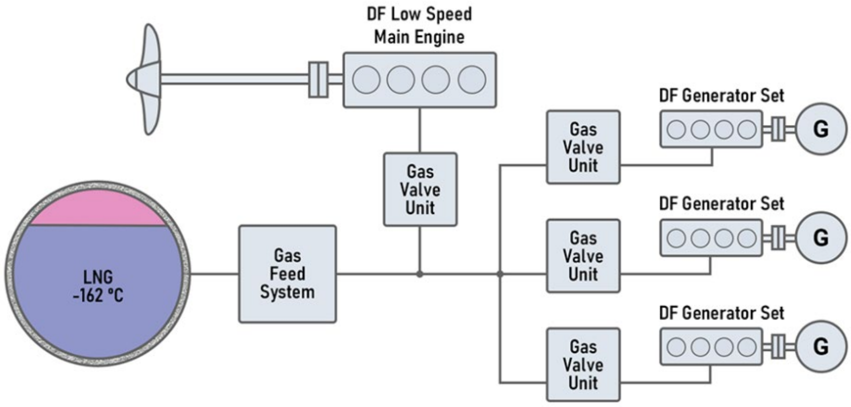
LNG as the ship's main and auxiliary engines fuel

In this chapter, students will learn about the components and their functions in the fuel system utilizing LNG as a fuel.

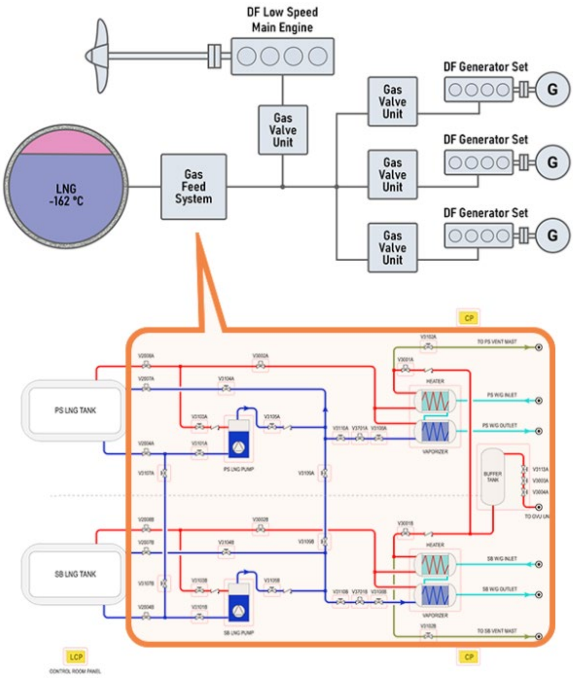
The main elements of the ship's LNG system include:

- Storage Cryogenic Tank

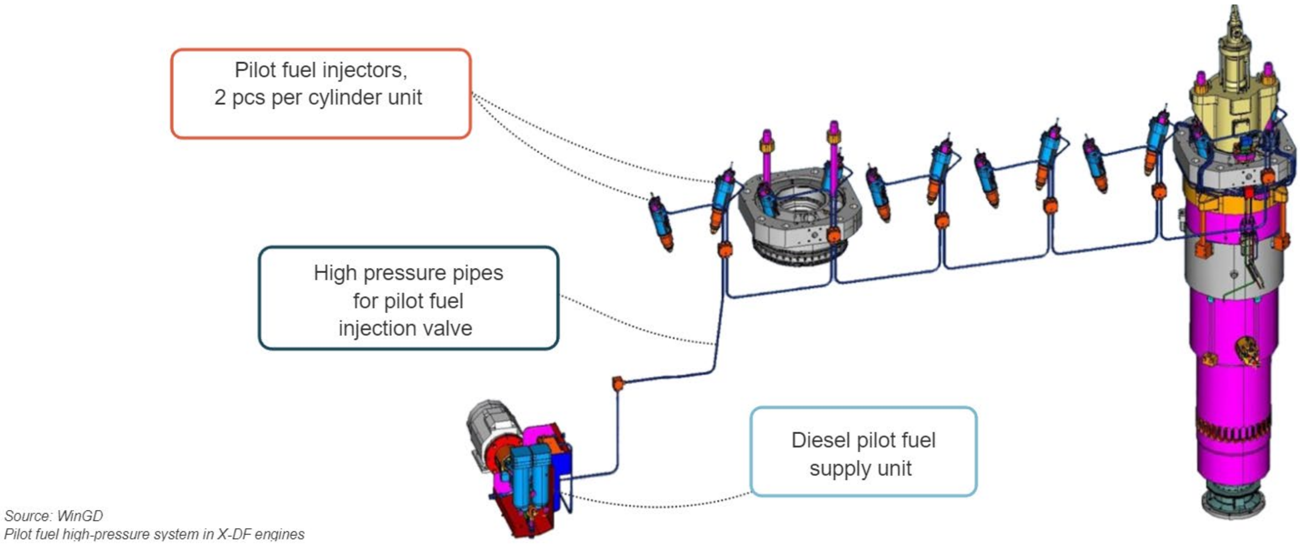
- Gas preparation and delivery systems
- Gas pressure regulation and temperature monitoring …



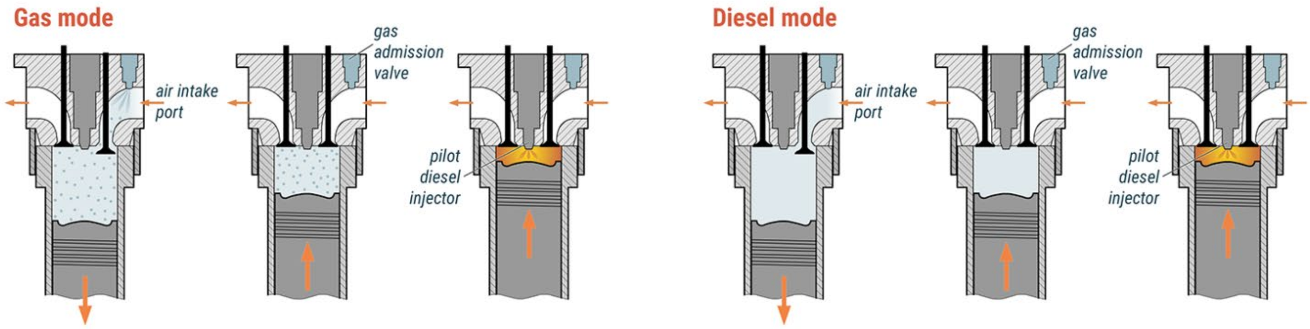
Next, students will learn about the details of the components of the mentioned systems.



In the following steps, students familiarize themselves with the details of the operation of Dual Fuel slow speed two stroke marine main engines.



At the end of this current chapter, we will analyze the fundamental aspects of the operation of Dual Fuel four stroke marine engines.



LNG Bunkering

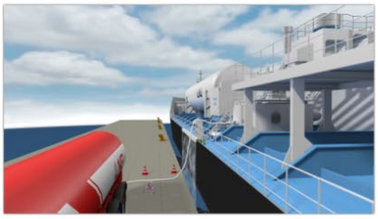
In this chapter, we will focus on procedures and regulations related to bunkering for ships using LNG as fuel.

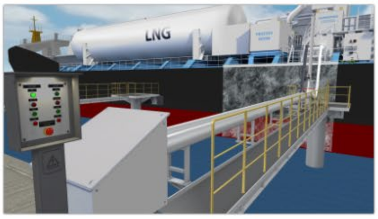
Loading LNG into fuel tanks is a different process from loading HFO due to some unique differences in the fuel's characteristics such as:

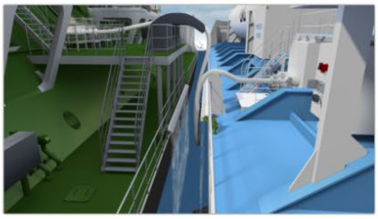
- LNG is carried out as boiling liquid
- LNG is cryogenic liquid at temperatures of about -162 degC,
- LNG vapor can form explosive clouds in confined spaces and is considered hazardous

International Association of Classification Societies (IACS) created the LNG Bunkering Guidelines. This guideline provide recommendation for:

- Responsibilities
- Procedures
- Equipment required for LNG bunkering operations





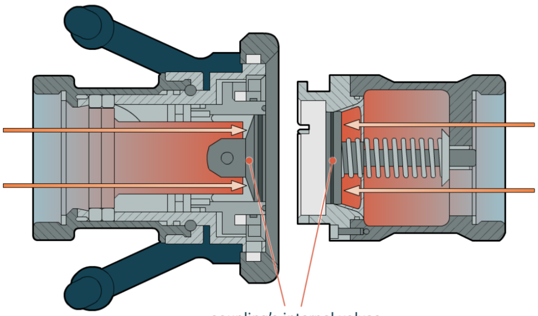


Students may become familiar with the bunkering process by analyzing provided guidelines.

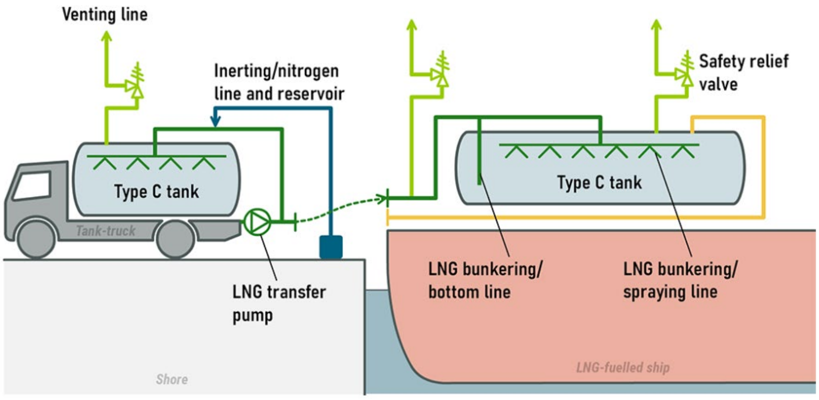
The LNG Bunker Management Plan (LNGBMP) is also required by IACS, so it will be discussed in this chapter.

Next, technical requirements during the LNG bunkering process will be discussed.

Students may become familiar with the Dry Cryogenic Coupling (DCC) functions and operations.



At the end of the chapter, students familiarize themselves with the methods of LNG bunkering.



Assessment

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