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LIST OF ABBREVIATIONS

ABS – American Bureau of Shipping

AFS – Anti-fouling System Convention

AIS – Automatic Identification System

ASA – American Shipmasters' Association

BMWP – Biological Monitoring Working Party

BV – Bureau Veritas

BWM – Ballast Water Management

BWRB – Ballast Water Record Book

CBT - Computer Based Training

CCS – China Classification Society

CIC – Concentrated Inspection Campaign

CMIC – Caribbean Maritime Information Center

COC – Certificate of Compliance

COLREG – the Convention on the International Regulations for Preventing Collisions at Sea

CRS – Croatian Register of Shipping

DNV – Det Norske Veritas

DPA - Deputy Person Ashore

DWT - Deadweight

EEBD – Emergency Escape Breathing Devices

EEDI – Energy Efficiency Ship Index

EF – Excess Factor

EU – European Union

EULA – End User License Agreement

FFE – Fire Fighting Equipment

FIC – Focused Inspection Campaign

FLNG – Floating liquefied natural gas unit

FPSO – Floating production storage and offloading unit

FSRU – Floating storage regasification unit

GA – Green Award

GL – Germanischer Lloyd

GPG – General Policy Group

HAZMAT – Hazardous Materials

HCD - Human Centred Design

HRS – High Risk Ship

HSSE – Health, Safety, Security & Environment

IACS – International Association of Classification Societies

IAPH – International Association of Port and Harbors

IAPP – International Air Pollution Prevention

IBC – International Bulk Center

IBWMC – International Ballast Water Management Certificate

IEEC – International Energy Efficiency Certificate

IHM – Inventory of Hazardous Materials

ILO – International Labor Organization

ILO 147 - the Merchant Shipping Convention

IMDG - International Maritime Dangerous Goods

IMO – International Maritime Organization

IMSBC - International Maritime Solid Bulk Cargoes

IOPP – International Oil Pollution Prevention

IRS – Indian Register of Shipping

ISGOT – International Safety Guide for Oil Tankers and Terminals

ISM – International Safety Management

ISO – International Organization for Standardization

ISPS – International Ship & Port Facility Security Code

KPI – Key Performance Indicator

KR – Korean Register

KRI - Key Result Indicators

LR – Lloyd's Register

LRS – Low Risk Ship

LSA – Life Saving Appliances

MARPOL – International Convention for the Prevention of Pollution from Ships

MASS – Maritime Autonomous Surface Ships

MEPC – Marine Environment Protection Committee

MLC – Maritime Labour Convention

NKK – Nippon Kaiji Kyokai

NOx – Nitrogen Oxides

PI – Performance Indicators

PIF - Performance Influencing Factors

PRS – Polish Register of Shipping

PSC - Port State Control

PSCO – Port State Control Officer

PWOM – Polar Water Operational Manual

QMS – Quality Management System

QSCS – Quality System Certification Scheme

R.O. – Recognized Organization

RINA – Registro Italiano Navale

RS – Russian Maritime Register of Shipping

SEEMP – Ship Energy Efficiency Design Index

SIRE – Ship Inspection Report Program

SMS – Safety Management System

SOLAS – International Convention for the Safety of Life at Sea

SOx – Sulphur Oxides

STCW - International Convention on Standards of Training, Certification and Watchkeeping
for Seafarers

STCW - Standards of Training, Certification and Watchkeeping

TBT – Tributyltin

TKK – The Imperial Marine Association (Teikoku Kaiji Kyokai)

UN – United Nations

USCG – U.S. Coast Guard

USSR - Union of Soviet Socialist Republics

UWILD – Underwater Inspection in Lieu of Dry-Dock

ABSTRACT

Maritime transport holds the largest and the most important share of world transport with a percentage of up to 90%. The main purpose of this dissertation is to analyze the external inspections which carried out in ships and ensure the safety of the vessel, the crew, the ports and the environmental protection and sustainability. The main categories of inspections are: the TMSA, the Vetting Inspections, the Flag Inspections, the Green Award Inspections, the Port State Control and the Classification Society. Their combination or even each one individually has significant effects on the economy and the company's overall appearance. An important reference is the historical development of inspections and how they began to be implemented. Additionally, every kind of external inspection displays the required procedure to be followed and several elements. It is important to highlight that the TMSA and Vetting inspections correlate with the tanker ships and oil companies. On the other hand, the Port State Control and the Classification Society concerns all kind of merchant ships. It is known that the international literature lacks studies of the external inspections, but the researchers acknowledge is rich of studies that examine this kind of issue and explain the implementation in the shipping industry.

Key Words: Safety Management Systems, Performance Measurement, Continual Improvement, Port State Control, Memorandum of Understanding, Inspection, Clear Grounds, Detention, Classification societies, Certificates, Survey, Vetting, OCIMF, SIRE

ΠΕΡΙΛΗΨΗ

Οι θαλάσσιες μεταφορές κατέχουν το μεγαλύτερο και το σημαντικότερο μερίδιο των παγκόσμιων μεταφορών με ποσοστό έως και 90%. Κύριος σκοπός της παρούσας εργασίας είναι η ανάλυση των εξωτερικών επιθεωρήσεων που πραγματοποιούνται στα πλοία και η διασφάλιση του σκάφους, του πληρώματος, των λιμανιών και της περιβαλλοντικής προστασίας και βιωσιμότητας. Οι βασικές κατηγορίες επιθεωρήσεων είναι το TMSA, το Vetting, οι Επιθεωρήσεις του Κράτους Σημαίας, τα Green Awards, ο Κρατικός Έλεγχος του Λιμένα (PSC) και ο Νηογνώμονας. Ο συνδυασμός τους ή και το καθένα ξεχωριστά έχει σημαντικές επιπτώσεις στην οικονομία και τη συνολική εμφάνιση της εταιρείας. Σημαντική αναφορά αποτελεί η ιστορική εξέλιξη των επιθεωρήσεων και το πώς ξεκίνησαν να υλοποιούνται. Επιπλέον, κάθε είδους εξωτερική επιθεώρηση παρουσιάζει την απαιτούμενη διαδικασία που πρέπει να ακολουθηθεί και διάφορα άλλα στοιχεία. Είναι σημαντικό να τονιστεί ότι οι επιθεωρήσεις TMSA και Vetting συσχετίζονται με τα δεξαμενόπλοια και τις εταιρείες πετρελαίου. Από την άλλη, ο κρατικός έλεγχος λιμένα και ο Νηογνώμονας αφορούν κάθε είδους εμπορικά πλοία. Είναι γνωστό ότι η διεθνής βιβλιογραφία στερείται μελετών για τις εξωτερικές επιθεωρήσεις, αλλά υπάρχουν αρκετές μελέτες που εξετάζουν αυτού του είδους τα ζητήματα και εξηγούν την εφαρμογή στη ναυτιλιακή βιομηχανία.

Λέξεις-Κλειδιά: Συστήματα Διαχείρισης Ασφαλείας, Μέτρηση Απόδοσης, Συνεχής Βελτίωση, Έλεγχος Λιμένα, Μνημόνιο Κατανόησης, Επιθεώρηση, Κράτηση, Νηογνώμονες, Πιστοποιητικά, Αξιολόγηση

1. INTRODUCTION

This dissertation analyses the role of classification societies in the shipping industry starting with a brief historical background of each classification society as well as a presentation of all members of the association in terms of each fleet and orientation.

After each classification society is analyzed, the role of the International Association of Classification Societies (IACS) is introduced, as well as its compliance with the International Maritime Organization's (IMO) rules and regulations. In particular, the criteria that each classification society shall comply with in order to become a member of the association, the rights, the obligations and also the suspension or withdrawal procedures will be listed.

An explanation of each main classification society's survey will follow. The class renewal, the intermediate and the annual surveys, the docking survey, the propeller shaft survey and the boiler survey as well as their scope of inspection will be explained in detail. Furthermore, the role of each classification society regarding the statutory surveys and their relation to the flag administrations will be cited.

In the last part of this chapter the focus will be on the class and statutory certificates, which are considered as a crucial aspect in a vessel's operation. Each one of the class certificates, their scope and validity will be presented. The statutory certification will follow, describing each certificate such as the safety construction, the safety equipment, the load line, the inventory of hazardous materials or the ballast water management of a vessel as well as the necessity, the regulation, the inspection procedure and the validity.

1.1 DEFINITION

Classification societies are non-governmental organizations which have been developed to verify that a vessel and all other maritime parties meet the standards related to safety and pollution prevention.

These societies are carrying out statutory inspections on behalf of flag administrations to certify that the regulations of international conventions such as SOLAS, MARPOL and codes like ISM and ISPS are being followed.

Furthermore, classification societies develop rules for the proper operation and maintenance of a vessel's propulsion, power generation and hull's strength and condition. For the development of each rule, the class societies are taking into consideration previous experience gained through all these years of classing various vessel's types combined with the research that is being made regarding the technical requirements.

Those rules are applied both during vessel's construction and operation. If a vessel is built under a specific class's rules and regulations, it may apply for a classification of this society. The class can be maintained for a vessel through a variety of periodical surveys. These surveys can either be annual or 5-year.

It is understood that in order for a vessel to maintain its class, it should be well equipped, maintained and manned with a skilled crew and qualified personnel ashore. In case that an incident or damage occurs on a vessel's hull or equipment, the owner must notify the class immediately. The class then issues a conditional certificate, giving time for rectification to the owner and preventing regulatory bodies (for example the port state control) to detain the vessel.

Although a vessel's classification and relevant certification indicates that it follows the rules and regulations, it should not be considered as a warranty of its safety and seaworthiness. A classification society may only verify the condition of a vessel and not the way that it is manned, operated or maintained.

Responsible parties other than classification societies that are preserving maritime safety are port state control authorities, shipowners, shipbuilding yards, underwriters, banks financing shipping companies and charterers.

Today, more than 50 organizations are describing their activities as classification service providers. Out of a total of 50 organizations, a large percentage of the global fleet is subject to the classification of 12 of those classification societies, which compile the International Association of the Classification Societies (IACS).

1.2 HISTORY

In 1760, all parties related to the shipping industry (shipowners, merchants and captains) were often gathering at the coffee house of Edward Lloyd's to discuss shipping news, make new deals and evaluate the possible rewards and risks for each

scheduled voyage. Once a voyage was fixed, then one insurer had to sign a document, stating that in case of a cargo loss, he should compensate the merchant who owned the cargo or the shipowner, a practice known as underwriting.

In order for the underwriters to properly evaluate which of the vessels they were pledging to compensate, they formed the first classification society, known as Register Society, today known as Lloyd's Register (LR). This society's main objective was to class each vessel on an annual basis in the following 3 categories:

G – Good later replaced by 1

M – Middling later replaced by 2

B – Bad later replaced by 3

The above 3-type classification was focused only in evaluating the possible risk and not the vessel's safety or seaworthiness. Half a century later the second classification society was formed in Antwerp and moved to Paris, known as Bureau Veritas (BV). During that time, surveys have been carrying out only by former captains. In 1834, Lloyd's Register started to employ surveyors and compose a general rules guideline, which was published that year. This guideline was referring to the vessel's construction and maintenance.

Once the guideline was published and its common rules were adopted by the majority of the underwriters, other nationalities began forming their own classification societies.

2. CLASSIFICATION SOCIETIES

2.1 TODAY

Nowadays, the international trade demand is constantly rising and due to the fact that around 80% of that trade is carried by sea (UNCTADSTAT, 2021), it is understood that the vessels number will rise too. In comparison with the year 2005, the global fleet expanded twice its size, and by the end of year 2020, there were 62,100 vessels trading globally (UK Department for transport, 2021). All these vessels have to be classified and evaluated accordingly, in order to preserve the maritime pollution in low levels and the safety of life at high standards. The classification societies are the only organizations that have the right to provide this evaluation will be analyzed below.

2.2 LLOYD'S REGISTER (LR)

Formed from the coffee house of Edward Lloyd (1760), a place where shipowners, merchants and captains were gathered to exchange news, experiences and to make deals. The first Register of Ships was printed in 1764, a database in which one could find the condition of a vessel and evaluate if he should proceed with the trade or not. This database was updated on an annual basis, classifying self-propelled vessels with a tonnage of 100 tonnes or more.



Figure 1 Lloyd's Register Logo (Lloyd's Register, 2021)

Presently, Lloyd's Register is considered as one of the most important classification societies, leading the gas tanker fleet (Lloyd's List, 09 December 2020). Lloyd's Register is having 7,559 vessels under its registry with a total capacity of 326,901,373 DW tons (International Association of Classification Societies, 2021). The organization's headquarters are located in the city of London, UK. Having open its own research lab in 2020, Lloyd's Register's focus is on industry's decarbonization, a project which is under development through a collaboration with academics and some ship management companies.

In addition to its fleet's decarbonization, LR is providing classification and compliance services both in marine and offshore industries, consulting throughout a vessel's construction and operation and advising its clients for fleet optimization, emergency response, risk management, fuel testing and fleet management.

Lloyd's Register offices are located in more than 70 countries, providing services for clients based in 182 different countries. Basis the IACS annual review of 2020, the number of exclusive ship surveyors is 1,011 and the organization's plan approval engineers are 438.

2.3 BUREAU VERITAS (BV)

Bureau Veritas was established in Antwerp, Belgium, with a mission to classify merchant vessels in order to assist insurers for proper evaluation and to ensure the value of the property of the shipowners and the lives of the crews. In 1829 the classification renamed to Bureau Veritas and in 1833 the organization's headquarters moved to Paris, France.



Figure 2: Bureau Veritas logo (Bureau Veritas, 2021)

Today, Bureau Veritas has a total of 9,389 vessels in its registry, with the most common types of vessels (tankers, bulk carriers and containers) to form a 30% of its fleet. BV is oriented in other types of vessels, such as dredgers, cruise ships, offshore service vessels and tugboats. Further to the usual services of a classification society, Bureau Veritas also provides marine fuel testing, cyber security and offshore units (drilling, FLNG, FPSO, FSRU) services. The society is currently the employer of 931 ship surveyors and 308 plan approval engineers (International Association of Classification Societies, 2021), having 180 survey stations globally **Invalid source specified..**

2.4 REGISTRO ITALIANO NAVALE (RINA)

The Italian classification society formed in 1861 in Genoa under the already existing British and French standards. Currently, RINA has a total of 3,977 vessels. Classification's bigger sector are the bulk carriers (dry), counting 400 vessels with almost 26 million DWT tonnes (International Association of Classification Societies, 2021).



Figure 3: Registro Italiano Navale logo

RINA is providing classification and statutory services for all types of vessels with its 523 surveyors and over 200 offices worldwide. In 2020, during COVID-19 outbreak, the Italian classification society was the first class that carried out statutory and intermediate surveys remotely (Sam Champers, 11 June 2020). In particular, drones were used in areas that needed a close-up survey, such as a thorough inspection inside cargo and ballast tanks.

2.5 AMERICAN BUREAU OF SHIPPING (ABS)

Founded in 1862 in New York as American Shipmasters' Association (ASA), with the scope of evaluating and certifying to the shipowner the captains for vessels' operations during the Civil War. Those vessels' which were under the command of ASA approved shipmasters would be better covered by insurance. In 1890 the ASA issued the "ABS rules for building and classing steel vessels" (Wikipedia, 2021), a guideline that exists and is updated to this day. In 1898 the organization was renamed to American Bureau of Shipping (ABS).

Currently, the American Bureau of Shipping's fleet is a total of 7,956 vessels with a sum of almost 392 million deadweight tonnes, the second biggest deadweight tonnage class (International Association of Classification Societies, 2021). The American classification society is having in its registry the biggest share in the fleet of tankers, a very important section in shipping. Among its objectives, ABS has provided insight in cooperation with big shipping companies to prepare the shipping industry for decarbonization.



Figure 4: American Bureau of Shipping logo (Wikipedia, 2021)

The American Bureau of Shipping is having 1,309 exclusive ship surveyors and 566 plan approval engineers, providing services to 70 countries worldwide with 200 offices.

2.6 DET NORSKE VERITAS (DNV)

DNV was formed in 1864 in Norway, to provide evaluation for the Norwegian merchant vessels. In 2012, DNV was merged with Germanischer Lloyd (GL), after the approval of all other classification societies, and renamed to DNV GL. In 2017 the biggest investor of GL sold his share to DNV and the classification's final name was set out as DNV.



Figure 5: Det Norske Veritas logo (Wikipedia, 2021)

The Norwegian class is on top of the other societies basis the number of vessels and gross tonnage. Particularly, it's fleet lists 8,712 vessels and a total of 276 million gross tonnes. DNV leads in the container vessels sector having a total of 1,734 containerships.

Among its services, DNV provides advisory support, offshore classification and digital solutions. It also focuses on alternative fuels, studying and comparing fuels such as ammonia or hydrogen that will be used to pave the way for decarbonization (DNV, 2021). DNV is currently employing 1,430 exclusive ship surveyors and 560 plan approval engineers, having 350 offices in more than 100 countries worldwide (Wikipedia, 2021).

2.7 NIPPON KAIJI KYOKAI (NKK)

The Japanese classification society was founded in November 1899 in Tokyo, then called Teikoku Kaiji Kyokai (TKK, the Imperial Marine Association) (ClassNK, 2021). The purpose of its establishment was to provide the regulations and the development of Japan's shipping and shipbuilding industries. In 1919, the TKK collaborated with three classification societies, quite recognizable for the time, the British, the Italian and the American, thus gaining international recognition.



Figure 6: Nippon Kaiji Kyokai logo (ClassNK, 2021)

At the end of World War II, it was renamed to Nippon Kaiji Kyokai (NKK, 1946) and as the Japanese shipbuilding industry began to recover, the Japanese classification society began to increase its fleet and regain its worldwide recognition.

Today, the Japanese classification society has the most, by far, bulk carriers in its registry. Particularly, its fleet consist of 7,559 vessels, with more that 50% being bulk carriers. The NKK total in bulkers gross tonnage is almost 165 million tonnes (International Association of Classification Societies, 2021). The class' exclusive ship surveyors are 1,183 and its plan approval engineers 193, having worldwide coverage.

The Japanese classification society is engaged in the study of carbon recycling on ships and the design of ships that will consume liquefied ammonia.

2.8 RUSSIAN MARITIME REGISTER OF SHIPPING (RS)

The foundations for the establishment of the Russian classification society have existed since the beginning of the 18th century, when there was a need for technical inspection of the ships of the Russian fleet. The year of founding of the Russian classification society is 1913 (RS Class, 2021) and in 1915 the organization recorded and published it's first rules for the construction of seagoing steel ships. In 1924, due to political matters, it was renamed as USSR Register and 11 years later, in 1935, the Russian

Classification Society was recognized by the IACS. In 1992, the organization was renamed to its current name, Russian Maritime Register of Shipping (RS).



Figure 7: Russian Maritime Register of Shipping logo (RS Class, 2021)

Today, the Russian classification society provides, in addition of a class' main services, the monitoring and supervision of the construction of arctic or polar vessels. The organization has also partnered with a company that manages ships sailing in the Arctic, in which it will take data from ship voyages and analyze them to increase the safety of ships traveling in these difficult conditions (Safety4Sea, Editorial Team, 14 June 2021). Russian Register of Shipping currently has 663 exclusive ship surveyors and 73 plan approval engineers and 2,432 vessels with a total gross tonnage of 12,6 million tonnes (International Association of Classification Societies, 2021).

2.9 POLISH REGISTER OF SHIPPING (PRS)

The Polish classification society was created in 1936 and became a member of IACS in 1972. Almost 30 years later, in 2000, IACS ended its cooperation with the Polish classification society after the sinking of a vessel under its registry, the Leader L. On 2011 PRS joined IACS again. The classification society employs 68 exclusive ship surveyors and 39 plan approval engineers. The vessels under its registry are 430 with a total gross tonnage of 9 million tonnes.



Figure 8: Polish Register of Shipping logo (PRS, 2021)

2.10 CROATIAN REGISTER OF SHIPPING (CRS)

The Croatian classification society was founded in 1949 and became a member of IACS in 2011. Today the organization has 337 ships registered with a total of 1,8 million gross tonnes. CRS offices are located mainly in the Balkans.



Figure 9: Croatian Register of Shipping logo (CRS, 2021)

2.11 CHINA CLASSIFICATION SOCIETY (CCS)

China classification society was established in 1956 and joined the IACS in May 1988. Currently, the Chinese classification society has the sixth biggest fleet under its register, with the 50% of the total tonnes being dry bulk carriers. Specifically, the Chinese register is surveying almost 4,000 vessels, with a total gross tonnage of 120,6 million tonnes (International Association of Classification Societies, 2021).

The speed of development of this classification society is mainly based on the development of Chinese shipping companies, for which it is the exclusive classification society.

The Chinese classification society recently signed a memorandum of cooperation with the port of Tianjin and the Wartsila company, with main purpose the optimization of the effectiveness and safety within the port, in terms of the exploitation of the new type of tugs (Reporter, 30 November 2021).



Figure 10: China classification society logo (CCS, 2021)

The company will provide operational data to the classification society in order to create the first guidelines for the management and maintenance of smart tugs in ports.

The Chinese classification society has 1,002 exclusive ship surveyors, 233 plan approval engineers and 120 offices located across the globe.

2.12 KOREAN REGISTER (KR)

The history of the Korean classification society begins with its founding in 1960. In 1988 its fleet reaches 10 million gross tonnes and becomes a member of IACS. Today, the classification society lists almost 2,000 vessels, with a total of 69 million gross tonnes and 59 offices around the globe. More than 30% of its fleet are dry bulk carriers. The organisation's plan approval engineers are 105 and its exclusive ship surveyors 587.



Figure 11: Korean register logo (Wikipedia, 2021)

The Korean classification society was the first among the members of IACS to approve the construction of the largest liquified hydrogen carrier, a vessel that will carry 20,000 cubic meters of the new fuel trend (Seatrade Maritime News, 26 October 2020).

2.13 INDIAN REGISTER OF SHIPPING (IRS)

The Indian Classification Society was established in 1975 by the Government of India and joined the IACS as a full member in 2010. Currently, the classification society has 140 exclusive ship surveyors, 64 plan approval engineers and 1,028 vessels under its registry. The organization's biggest section in gross tonnage are the tankers, having more than 50% of its total tonnage and it is recognized by 43 flag authorities (International Association of Classification Societies, 2021).



Figure 12: Indian register of shipping logo (IRClass, 2021)

2.14 HELLENIC REGISTER OF SHIPPING (HRS) – NOT A MEMBER OF IACS

The Hellenic Register of Shipping was established in 1919 in Greece, dedicated to the safeguarding of life and property at sea, the prevention of marine pollution and the quality assurance in industry. This Classification Society is not an IACS member but was collaborating with several Classification Societies under IACS, for the issuance of statutory certificates. Several of the Hellenic Register of Shipping activities are listed below:

- Inspections for a vast variety of ship's types and relevant issuance of trading and statutory certifications (on behalf of 28 flag administrations).
- Maintenance surveys of all critical machineries related to the vessel's operations.
- Supervision and guidance for special projects such as new-buildings or conversions. Particularly, the Hellenic Register of Shipping was the

Classification Society, which was supervising the new-building progress of the vessels built in Greek shipyards for the Hellenic Navy.

- Safety Management procedures monitoring and assessment both for a vessel's safety management plan and for a company's ISM Code.



Figure 13: Hellenic Register of Shipping Logo

Currently, the Hellenic Register of Shipping has under its registry many yachts and small craft vessels.

3. THE INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES (IACS)

3.1 ORIGINS AND RECOGNITION

The international association of classification societies was based after a recommendation during the International Load Line Convention (1930), suggesting that the already existing classification societies had to cooperate in order to ensure as much consistency as possible with regards to the freeboard's strength.

9 years later, based on this conference, the Italian classification society (RINA) hosted the first conference of the great classification societies until then. During this conference, the 7 biggest classification societies agreed to extend their cooperation.

In the year of 1968, the international association of classification societies (IACS) was formed, which consisted of 7 members, the Italian (RINA), the American (ABS), the French (BV), the Norwegian (DNV), the German (GL), the British (LR) and finally the Japanese (NK) classification society.

Shortly after its establishment, the association was internationally recognized for its technical knowledge and its experience gathered all these years during each of its member's activities. Thus, in 1968 the International Maritime Organization gave to IACS its consultative status, a status valid to this day. IACS is the only non-governmental entity having the authority to set and enforce rules as an observer.

3.2 IACS MISSION AND VALUES

IACS is an association, currently consisting of 12 classification societies, with primary scope the establishment, the promotion, the review and the development of minimum technical standards along with the vessel's inspection, maintenance, design and construction.

It also aims to support international regulators and organizations in enforcing legislation and industry standards in the design, construction and subsequent operation of the vessel, while improving maritime safety and pollution prevention.

The association manages to achieve these goals by having the following values (International Association of Classification Societies, 2021):

- **Leadership:** The ability to be ahead and collaborate with international organizations
- **Technical knowledge:** Through individual and collective technical expertise and experience, it manages to develop, adopt and implement technical regulations and requirements, which reflect the common practice and the variability of social requirements, while promoting new technology and innovation
- **Performance monitoring:** Members' commitment to setting and adhering to the highest global quality standards.
- **Transparency:** Advising on the implementation of regulations, interpreting and enacting them (when applicable), in order to develop practical solutions in collaboration with other parties.

The Association's effort in difficult circumstances guarantees the maritime industry's ongoing safe operation now and in the future.

3.3 GOVERNANCE STRUCTURE

The association is governed by the council, which consists of a senior executive of each classification society. The General Policy Group (GPG), which reports to the council

and is made up of a senior member of every classification society, is in charge of putting the council's general recommendations into action.

So far, the Chair of the general policy group was based on a rotational system, but in 2020, the association decided to change this policy and differentiate the Chair's procedure. Thus, to facilitate decision-making and consolidate the association's policies, the chair-making process will take place through elections. The members of the council will elect a member who will hold this position for the next 3 years, and along with that a supportive technical committee. In this way, the union, in addition to expanding its representation over time, succeeds in bringing a team of highly qualified experts closer to the International Maritime Organization (IMO). With these new changes, the international association of classification societies aims to identify potentially upcoming problems earlier and extend the time in which it can solve them. The association consists of even smaller categories of departments, responsible for different sectors within the maritime industry. Such sectors are:

- EU and global based standards expert groups, dealing only with regulations for decarbonization goals
- An EEDI (energy efficiency ship index) joint working group, promoting the use of less polluting engines in shipping
- Expert groups for various matters such as safety of surveyor, MASS (maritime autonomous surface ships), materials and welding, management systems, formal safety assessment and data
- Joint working groups dealing with cyber security systems and anchoring systems
- One small group specialized in coatings and one for quality policies
- One panel dealing with all vessel's important aspects, such as hull, surveys, safety, machinery, environmental and cyber systems

IACS Organisation 2020

IACS deals with multiple tasks to advance the goal of safer and cleaner shipping.

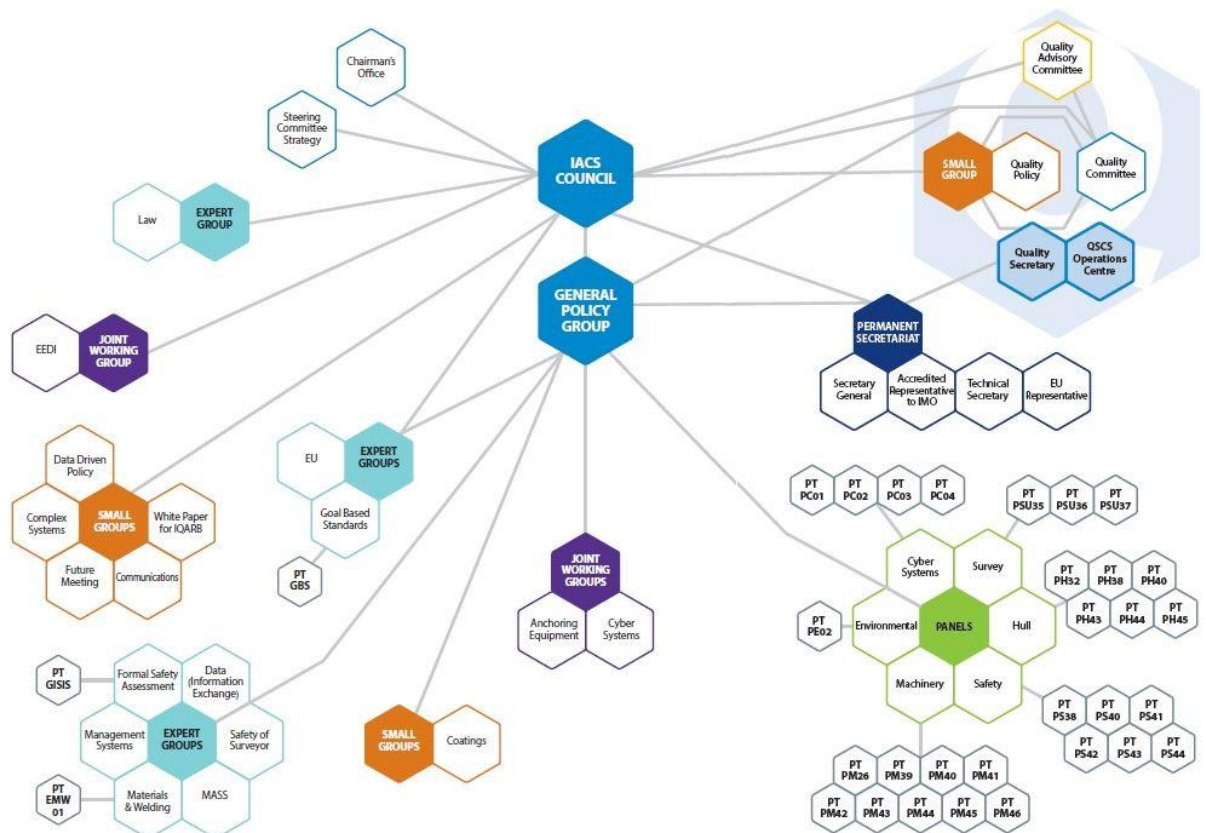


Figure 14: IACS organization 2020 (International Association of Classification Societies, 2021)

3.4 IACS MEMBERSHIP CRITERIA

Joining the international association of classification societies requires compliance with certain criteria, which are listed below:

Criterion 1 – Proof that the organization requesting membership in IACS has relevant qualification validating that it is a class organization, as specified under IACS' Annex 4.

Criterion 2 – The organization must follow the quality system certification scheme (QSCS), which validates that each classification society has built its unique management system, meeting the IACS requirements in regard to the internal quality.

Criterion 3 – The classification society should be capable of emerging, implementing, sustaining and reforming rules and regulations written in the English language on a

regular basis. These regulations should cover all aspects of a vessel's classification process, such as vessel's design approval and vessel's periodical or construction surveys.

Criterion 4 – The classification society should have the ability to provide surveys and periodical surveys during a vessel's construction and operation under the requirements of IMO, ILO and flag states.

Criterion 5 – The classification society should have a sufficient number of exclusive ship surveyors to meet the need for construction projects and surveys for ships in service.

Criterion 6 – The classification society must demonstrate that it has the experience to monitor and evaluate plans for the construction of the ship or its modification under the international regulations of the IMO and ILO conventions.

Criterion 7 – The human resources and expertise which composes the relevant society's departments should be complying with the size of the classified vessels under its registry.

Criterion 8 – The classification society should have its own technical ability to contribute to the development of minimum regulations and requirements in collaboration with IACS.

Criterion 9 – The classification society should contribute to IACS with its own resources on an ongoing basis as described in criterion 8.

Criterion 10 – The classification society's classed vessels should be in accordance with IACS resolutions, as defined in Annex 4

Criterion 11 – The classification society should grant written confirmation from the IMO safety committee that its rules and procedures meet the criteria of the “International Goal-Based Ship Construction Standards for bulk carriers and oil tankers (SOLAS Reg.II-1/3-10, IMO Resolution MSC.287(87))”.

3.5 IACS MEMBERS RIGHTS AND OBLIGATIONS

Once a classification organization enters the international association of classification society (IACS), it has the below rights (International Association of Classification Societies, June 2017):

- The organization can be considered as an IACS member
- - The organization has the right to attend and vote in all Council and General Policy Group meetings and deliberations (GPG)
- The organization has voting rights and can participate in all Working Groups
- The organization has voting rights and can participate in the Quality Committee
- The organization can join the IACS delegation to sessions at the International Maritime Organization (IMO).

Also, a member of the International Association of the Classification Societies has the below listed commitments:

- - Each member shall make a financial contribution to the IACS on equal financial terms with the other members of the association
- Each member should at all times satisfy the IACS membership standards
- Complete the “Membership Application and Periodical Verification of Existing Members verification process (at Annex 1)”
- Members should comply with the IACS procedures
- Each member should participate in the IACS Council Chair elections
- Members should comply with the IACS resolutions

3.6 SUSPENSION AND WITHDRAWAL PROCESS

When the council considers that a member of the association does not comply with membership criteria, then the following procedure commences for the member’s suspension or withdrawal (International Association of Classification Societies, June 2017):

- The IACS council notifies with a written statement the particular member that the suspension process has been initiated
- The notification declares the reasons why the procedure was initiated and provide a time window on which the member must comply and take actions for the rectification of the non-compliance
- If the time limit elapses and the Council notices that the member has not rectified the remark, then it may suspend the member from the association
- A reasonable time period shall be given to the member by the suspension decision during which the member should rectify the non-conformity
- The suspension’s verdict will not be activated unless the time of appealing to the Independent Appeal Board has passed, or unless the IACS Member notifies

the IACS Council that it has submitted interim actions in compliance with the Appeal Board Rules of Procedure

- Not any public announcement shall be made from either IACS ltd or IACS member, until the suspension decision takes effect
- The obligations of membership for the suspended IACS member continue to apply, except for the voting right.
- If the IACS suspended member does not succeed into rectifying the non-conformity, then IACS council may take the decision of the member's withdrawal, stating the reason of such decision
- Not any public announcement shall be made from either IACS ltd or IACS member, until the withdrawal decision takes effect
- An IACS member whose membership is withdrawn, may apply again to join the association only if 12 months have passed from the time that the association took the withdrawal decision.

4. CLASSIFICATION PROCEDURES

4.1 ASSIGNMENT OF CLASS

A ship is classified when all inspections have been completed satisfactorily, ensuring that the ship complies with the association's international rules. This assignment is provided under the below listed circumstances:

- After a new constructed vessel's commissioning and basis that all needed surveys have been completed successfully
- Upon completion of an existing vessel's successful survey, carried out in accordance with IACS international rules for vessel's that transferring their class (between IACS members)
- Upon completion of an existing vessel's successful survey, not classified yet under an IACS association member

4.2 MAINTENANCE OF CLASS

To maintain its class, a ship should be inspected regularly through several surveys. Some of those inspections are the annual survey (carried out on a 12-month basis), the intermediate survey (carried out on a 2.5 year basis) and the special survey (also called class renewal survey, carried out once every 5 years). Also, the docking survey (which can either be carried out in dry-dock or in-water with the assistance of divers) evaluating the condition of the vessel's hull, the tail shaft survey confirming that the condition of the propeller is operating satisfactory, the boiler survey and the machinery survey checking the condition of various critical machineries onboard. Each of the above mentioned surveys is performed regularly, depending on the date of its last

completion. Some of the surveys are required to be carried out on an annual basis, and some are less frequent, such as the special survey, which can be carried out either every 5 years or every 2.5 years, subject to vessel's age.

All the surveys are ensuring that the vessel is complying with relevant requirements and that each of the critical categories is in accordance with the classification societies regulations. It is the owner's duty to maintain the vessel's condition at a adequate conditionl, sufficient enough to keep the class of the vessel maintained.

The range and the scope of an inspection is subject to the vessel's condition and equipment (IACS, 2020). In case that the surveyor determines that the ship's state or a part of its systems is insufficient or defective, then a further examination will be required.

4.3 SUSPENSION OF CLASS

The classification society may suspend the class of a vessel for the following reasons:

- In case that a vessel's operation and maintainance are complying with the classification's rules and requirements
- When a vessel has less freeboard than assigned
- When a damage occurs to a vessel and the owner fails to inform the class and request a survey on the defected equipment
- When modifications are carried out on the vessel for critical equipment (indicated by the class) without a surveyor's witnessing

Furthermore, a class may be suspended directly for the following:

- When the renewal survey is not complete within the time frame given by the class
- When the intermediate or the annual surveys are not complete by the given due date

A suspension of the above reasons will have effect until the vessel carries out the required surveys and any further survey that the class can consider necessary. Some additional circumstances that may lead to consideration of a vessel's class suspension are the below:

- When a condition of class (also called a class recommendation) cannot be rectified within the due date given by the classification society, unless it is agreed with the classification society or it has provided relevant documentation in order to acquire a postponement

- In the cases that the surveys are not complete within the time window given from the class status
- When the classification society considers that the vessel cannot maintain its class due to the nature of the reported defect
- When an owner does not request to carry out a survey

4.4 WITHDRAWAL OF CLASS

A classification society may withdraw a vessel from its registry if:

- The owner of a vessel has decided so
- The suspension of the vessel dates more than six months
- A vessel is considered to be a constructive total loss and the owner has no intention on repairing it
- A vessel is reported lost
- An owner declares that the particular vessel will not trade anymore

4.5 NOTIFICATION OF SUSPENSION OF CLASS

Once a vessel is suspended or withdrawn by the class, the organization will notify the owner, the underwriters and the flag administration and will publish relevant information on the appropriate databases.

4.6 DEFINITIONS OF CLASSIFICATION SURVEYS

PERIOD OF CERTIFICATE OF CLASS

The duration of each class' certificate commences either from the day of the initial classification or from the day of the last special inspection (also called class renewal). The period of the certificate expires at the due date that has been assigned for the next class renewal or special survey.

ANNIVERSARY DATE

The anniversary date is stated in the certificate of class and it is the day and the month which relates to the due date of the certification.

SURVEY TIME WINDOW

The survey time window is the period that a survey can be carried out, offering to the owner time to decide when the vessel will be surveyed.

4.7 OVERDUE SURVEYS

Each survey has a predetermined commencement and due date, by which needs to be completed. If the survey has not been carried out by its due date, it becomes overdue.

RECOMMENDATION / CONDITIONS OF CLASS

The class condition and recommendation are the same thing, providing additional time to the owner to rectify a malfunction that is affecting the vessel's class status. Once the malfunction is restored, the vessel may retain its class. In order for the class to give a recommendation / condition, the ship manager must notify the classification society once the damage occurs.

MEMORANDA

Memoranda may be information that surveyors have to take into consideration prior their attendance. Memoranda may include several notes related to materials and other constructional information or can define a condition that deviates the technical standards but have no effect at a vessel's classification status.

5. CLASS SURVEYS

5.1 CLASS RENEWAL – SPECIAL SURVEY

Class renewal survey is a major survey carried out at five-year intervals. Visual checks, measurements, and inspections of the vessel's hull, as well as the vessel's important auxiliary machinery, are all part of the survey. The main scope of the class renewal survey is to verify that the vessel satisfies the relevant rules of the society.

The class special survey can commence during the 4th annual survey and may finalize on the 5th anniversary date. In exceptional circumstances, the class renewal survey may be extended to a 3-month period after the survey's expiration date. However, in those cases, the future surveys will be initiated from the expiration date prior to vessel's extension due date.

In case that a surveyor finds deficiencies during the vessel's class renewal survey, owners should rectify same prior to the special survey's completion. Minor deficiencies found may be included as conditions of class and should be rectified within a specific time frame, not exceeding the usual 3-months period.



Figure 15: Docking survey (Applied Technical Services, 2021)

The class renewal survey initiates with the inspection of the vessel's hull and deck equipment. These inspections are essential as it is verified that the structural condition of the vessel remains effective. In addition, it helps detect significant corrosion, significant deformation, damage or any other structural wear.

The survey of the hull and deck equipment covers the below (DNV-GL, 2015):

- Thickness measurements of hull structure, depending on each vessel's age
- Anchoring equipment
- Hatch covers and coamings, where applicable
- Air pipes
- Examination of ballast tanks, watertight bulkheads, machinery areas, coating inside tanks of potable water, tanks of low flashpoint liquids
- Mooring and towing equipment
- Ship with movable car decks where applicable
- Ships equipped to carry containers
- Loading computer systems and instruments

The survey of the machinery and systems covers the below:

- Propulsion system
- Steering and manoeuvring systems
- Auxiliary systems
- Boilers and thermal oil heaters
- Auxiliary engines (for electrical power production)
- Systems allowing the vessel to carry special cargoes
- Tanks in the machinery area (lube oil tanks or fuel oil tanks)
- Water ingress systems

5.2 ANNUAL SURVEY

Annual survey is a general survey that is conducted within a time frame commencing three months prior and three months after each vessel's anniversary date. During the annual survey, the attending surveyor inspects the hull, the equipment and the machinery of the vessel and performs several tests that will verify the vessel's general condition.

Part of the annual survey includes the review of documentation, operational instruments and markings onboard the vessel. The attending surveyor will verify (DNV-GL, 2015):

- The validity of the certificate of loading computer system (if same is available onboard)
- Approved loading and stability information
- Manual with operational and maintenance guidelines needs to be validated for several items onboard, such as protective coating regarding the ballast tanks containing only sea water, arrangements for the washing of crude oil or system that controls the vapor emissions
- Evidence records, validating that the fire fighting equipment (fire extinguishers) have been inspected by authorized workshops
- Required signboards or notice plates
- Onboard evidence that the vessel's crew is maintaining all machineries according to the planned maintenance schedule properly
- Evaluation and review of the vessel's continuous machinery survey regarding all machinery and of the vessel's planned maintenance schedule for hull and machinery
- For the vessel's complying with SOLAS reg. II-1/3-5, a survey from the class will be conducted in order to validate that all materials used in installations onboard the vessel do not contain asbestos.

The next part of the annual survey includes the inspection of hull and equipment condition. In particular, the attending surveyor will examine:

- All side shell plating above the vessel's waterline and weather decks
- Mooring, anchoring and towing arrangement equipment
- Hatch covers and coamings arrangement, including the closing or opening mechanisms of the systems that are sealing the cargo hold
- All watertight areas, such as watertight bulkheads or watertight doors in the vessel's stern and bow
- Ventilator ducts inside the engine room area and ventilators or air pipes in all decks
- All discharges from the vessel's hull, including valves or scuppers
- Freeing ports and shutters
- Fittings and hull supporting structures, as far as practicable, for stowage, securing and supporting of timber deck cargoes, containers, movable car decks pontoons

- Securing and lashing equipment's condition, especially on open decks
- The condition of all pipes on main deck
- All safety-related items that are concerning the crew's health, such as guardrails gangways or bulwarks
- Areas found with significant corrosion
- Electrical installations' condition in regards to tanks or pipelines
- For operational safety, on vessels with car decks, a thorough examination shall be carried out regarding the accident prevention

The final part of the annual survey is the machinery and systems inspection. In particular the attending surveyor will examine:

- Inspection of spaces
- Boilers visual inspection
- Steam Drums visual inspection
- Visual examination of pressure vessels
- Validation of the operational condition of the fuel injection piping system and the insulation for hot surfaces (above 200 degrees Celsius)
- Incinerators
- Steering gear
- Fire protection systems
- Alarm systems, including alarm testing and fire alarms
- Boiler installations
- Operational testing on all quick closing valves
- Operational testing on bilge systems, their remote operation and alarm systems
- Operational testing regarding the bridge or engine control room communication with other machinery
- Systems allowing the vessel to carry dangerous cargoes
- Control or monitoring systems
- Emergency systems for passenger ships
- Electrical installations

5.3 INTERMEDIATE SURVEY

The intermediate survey may be conducted within the vessel's second and third annual survey. This survey's scope is the verification of the vessel's structural condition in accordance with the classification society's requirements. These requirements may differ subject to the vessel's age and type, and if the attending surveyor deems it necessary, further thickness measurements may be requested.

In general, the scope of the intermediate survey for all types of ships may cover (DNV-GL, 2015):

- Ballast tanks inspection
- Cargo compartments inspection

- In case corrosion is found anywhere inside the above areas, extended thickness measurements may be carried out
- Thorough inspection on the lower parts of the ballast and cargo tanks

Any areas that are identified either for their condition or found with corrosion, shall be recorded and be monitored during the future annual surveys. For ships aged between 5 to 10 years, an overall inspection shall be carried out to several representative ballast tanks, selected by the attending surveyor. If the representative tanks are in poor protective coating condition, extended inspection may be carried out to similar tanks.

For ships aged over 10 years, a thorough examination shall be carried out on all ballast tanks. Particularly, piping (such as cargo piping, bilge and ballast piping, air or sounding piping and fuel pipes) shall be inspected extensively.

Additionally, for the bulk carriers the intermediate survey also includes the thorough inspection of the hatch covers and its coamings, their sealing and securing devices. Proper operational test shall be conducted on all the above to validate the required operation of the vessel in accordance with the classification's rules. For oil and chemical tankers, a thorough examination shall be carried out to verify that all cofferdams, void spaces and pipe tunnels are in good condition. Also, testing shall be carried out on all deck's cargo piping, on cargo and ballast piping within the cargo holds area.

Regarding the machinery and systems, the intermediate survey's scope includes the inspection of the electrical installations, the fuel cell installations and the gas fueled engine installations. In addition to the above, an examination shall be carried out in possible gas-dangerous spaces with reference to substantial corrosion, correct rating of lamp, function testing of pressurized equipment and of related alarms and test on all insulation resistance of power circuits.

Especially for oil and chemical tankers, additional inspections are necessary, such as the examination of systems for cargo heating and cooling, heating coils, and tank cleaning apparatus.

5.4 BOTTOM / DOCKING SURVEY

The bottom / docking survey is an inspection of a vessel's hull and relevant items. Survey may be conducted afloat or when vessel is in dry-dock. In case that the examination is in progress when the vessel is afloat, then the survey is referred as in-water survey. In case that the examination is in progress when a vessel is in dry-dock, then the survey is referred as docking survey.

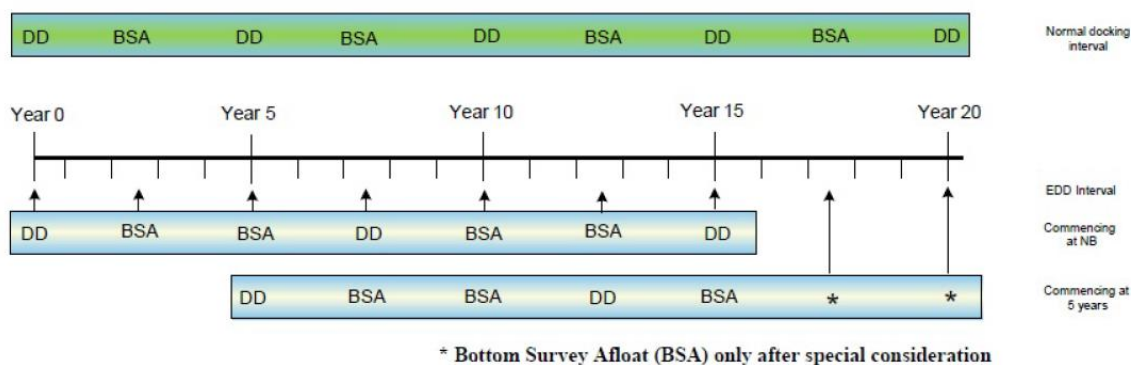


Figure 16: Dry docking scheme (DNV-GL, 2015)

The bottom survey is to be examined twice in a five-year time frame. Once the bottom survey is carried out successfully, then relevant certification of class will be provided by the surveyor, with a validity of 36 months maximum between the surveys. In this particular survey, the outside of the vessel's hull shall be examined thoroughly along with relevant items. The survey includes the examination of the below (DNV-GL, 2015):

- Plating of the vessel's hull and stern frame
- Sea valves, sanitary discharges and scuppers
- Shaft brackets
- Steering fins
- Rudder and rudder bearings
- Thrusters
- Propeller and the propeller's shaft (externally)
- Stabilizer fins

As mentioned before, an owner has the option to carry out the bottom survey afloat, an alternative that can save a significant amount of cost. If the owner decides to carry out the underwater inspection in lieu of drydock (UWILD), then he may apply to the class requesting same.

The classification society's department of ship's safety may request from the owner to provide the below documentation / information (Wingerden, 2016):

- Master's statement, stating the current condition of the hull and in case that a damage has occurred, to describe the location and the damage.
- The site of the survey in which the survey will be carried out. The visibility of the location's waters shall be 2 meters or greater in order for the survey to be carried out. Also, attention may be given to the direction of the current.
- The condition of the hull, which must be clean from any barnacles or other growths in order for the diver and the attending surveyor to have a clear picture of the hull condition

Once the classification society approve the owner's request and after evaluating the vessel's hull findings from the previous dry-docking survey, then the owner shall authorize a diving company to conduct the inspection, approved by vessel's classification society and relevant flag administration. During the survey, the attending class surveyor must be in direct contact with the diver via a closed-circuit television with two-way communication. After the survey's completion, a report should follow, describing all survey's findings and recommendations.



Figure 17: Bottom survey in progress (TTS, 2021)

5.5 PROPELLER SHAFT SURVEY

The propeller shaft survey is the thorough examination of the tube shafts and their bearings. The survey may be divided by the below examinations (DNV-GL, 2015):

- Full scope: The propeller shaft is drawn in order to provide access to carry out a thorough examination on the shaft and also on the related systems: shaft bearings, stern bearings and bushes, liners and corrosion inspection, sealing of the shaft including lubrication systems
- Reduced scope: In case the propeller shaft has a type approved sealing gland, the shaft's withdrawal is not necessary, but a thorough examination shall be carried out: new oil seals fitting, verification of the operation of inboard seal, measuring of the aft bearing seals, lubricating oil's level monitoring, historic records of the shaft's aft bearing temperatures, examination of oil sample analysis
- Partial scope for shafts with oil lubrication: the classification may extend by 2.5 years the survey, if the owner may provide the following documentation: measurements on the clearances of the aft bearing, oil consumption and monitoring of the lubricating oil, 6-monthly oil analysis from the system, temperatures from the shaft's aft bearing records, verification that the propeller has no damages



Figure 18: Propeller shaft withdrawal (Diesel Ship, 2017)

5.6 BOILER SURVEY

The boiler survey shall be carried out every 2.5 years. In the boiler survey, the following items are examined (DNV-GL, 2015):

- Boilers
- Drums for steam
- Generators for steam
- Steam separators

- Pipelines relevant to the boiler arrangement

Prior to the boiler survey, it is required from the owner to prepare all relevant systems for inspection. The boiler should be cleaned on both gas and water sides, secured from live steam systems, cooled down and well ventilated in order to provide access to the attending surveyor.

Once the systems are prepared for inspection, the classification society's surveyor will survey the following:

- System's visual inspection
- Inspection of safety valves, level, pressure and temperature transmitters for monitoring and control
- Inspection of relevant reporting regarding the maintenance schedule and system's operation
- Boiler's water management system inspection
- Examination of the settings on the system's safety valves
- Operational testing and functionality inspection regarding the safety valve's relieving gear

6. CLASS CERTIFICATE

6.1 ISSUANCE AND VALIDITY OF CLASS CERTIFICATE

The class certificate is issued to declare that ships is inspected for classification and is complying with the Classification Society's Regulations. It is issued to all classed vessels and includes the expiry date and the class notations assigned to the vessel.

More information such as vessel's classification number, IMO number, engine specification, port of registry, flag, built location and shipyard's info are also included in the documentation. The class certificate shall be valid until its expiry date subject to continued compliance with the Society's Rules and Regulations or in cases that suspension or withdrawal of class are not considered necessary.

The endorsements on the certification are validating that the vessel is being surveyed with periodical surveys (either annual or intermediate) and as per some classification societies practice, indicating that the vessel has several outstanding recommendations / conditions of class.

The classification certificate becomes invalid and the vessel's classification society is automatically suspended (according to the classification society's rules and regulations) for the following reasons:

- The owner has not applied and conducted the vessel's annual inspection within the vessel's timeframe
- The intermediate inspection has not been carried out within the required timeframe of the third annual survey's due date, unless vessel's subject survey is currently in progress

6.2 CLASS MAINTENANCE CERTIFICATE

The class maintenance certificate is a certificate that is indicating the condition of the vessel's class status within a specific time frame. The owner may request such certification for the following reasons:

- Sales purposes
- Insurance and claims purposes
- Register purposes
- Oil major purposes
- Newbuilding purposes

With the class maintenance certification, the owner is able to confirm to a potential buyer, a third-party company or in case of an accident, that the vessel is maintained (or was maintained for a specific time period) under the classification society's rules and regulations successfully.

The information that is included on a class maintenance certificate is the following:

- Vessel's IMO number
- Vessel's class number
- Vessel's name
- Vessel's flag
- Vessel's gross tonnage
- Certification that the vessel is maintained for a specific time period (requested by the owner) under the classification society's rules and regulations
- Indication of class conditions (if applicable) during the time period that the certificate was issued for

7. STATUTORY CERTIFICATES

7.1 AUTHORIZATION AND ISSUANCE

The classification societies may issue statutory certificates on behalf of flag administrations to certify that the regulations of international conventions such as SOLAS, MARPOL, STCW, MLC2006 and codes like ISM and ISPS are being followed.

Specifications and information regarding the statutory certificates may be requested by the flag administrations though. After surveyor's successful inspection, a relevant statutory certification will be issued or endorsed. Most of the certificates have a 5-year validity and after this time period, the certificate shall be renewed.

In case of a minor deficiency in the equipment related to one statutory certificate, the owner should notify the flag administration and the classification society and arrange rectification procedures. The flag administration may issue an authorization letter, instructing the classification society to attend onboard and inspect the defective equipment. After the completion of the inspection of the defective equipment, the classification society may issue a conditionally issued statutory certificate, providing an additional rectification period to the owner.

Once the malfunction of the defective equipment is restored, the owner should notify the flag administration and the classification society, arrange a class surveyor for attendance and after the attending surveyor's inspection is complete, the owner shall have the full-term version of the statutory certificate onboard.

The certificates that will be presented are the following:

- International Load Line Certificate
- Cargo Ship Safety Construction Certificate
- Cargo Ship Safety Equipment Certificate
- Cargo Ship Safety Radio Certificate
- International Oil Pollution Prevention Certificate
- International Air Pollution Prevention Certificate
- International Energy Efficiency Certificate
- International Sewage Pollution Prevention Certificate
- International Ballast Water Management Certificate
- International Anti-fouling System Certificate
- Document of Compliance, Special Requirements for Ships Carrying Dangerous Goods
- Polar Ship Certificate

- Inventory of Hazardous Materials Certificate
- International Tonnage Certificate
- Register of Lifting Appliances
- International Safety Management Certificate (ISM Code)
- International Ship Security Certificate (ISPS Code)
- Maritime Labour Certificate

7.2 INTERNATIONAL LOAD LINE CERTIFICATE

The international load line certificate is a statutory certificate which is applicable for all vessels with more than 24 meters length and more than 150 gross tonnes. The validity of the international load line certificate is 5 years. The only case that a load line certificate may be extended is when a vessel is not in port and en route to its destination, and the extension shall not exceed the 3 months period.

The initial survey of this certificate was carried out prior to the vessel's service commencement. The annual survey shall be carried out 3 months prior and 3 months after the anniversary date, in order to ensure that not any alternations have been made and that the information indicated on the certificate is correct. Its scope is the definition of the maximum allowed draft of the vessel and it's markings on the vessel's side shell (DNV, 2021).

As per the International Convention on Load Lines, 1966, Article 14 (International Convention of Load Lines, 2005):

- Prior to the vessel's commissioning, a survey shall be conducted in order to validate if the vessel's hull and systems are complying with the Convention's regulations.
- A survey shall be conducted once the vessel is within the timeframe given by the classification society for a periodical examination. The scope of the survey remains the same of with the survey prior to vessel's commissioning, to ensure that the vessel still complies with the Convention's regulations. Also, the survey's scope includes the verification that no alternations or modifications have been made, and in case of any changes on vessel's hull or superstructure occurred, those are not affecting the load line position.
- All surveys conducted under the Convention's regulations shall be included in the vessel's load line certificate as endorsements.

In Article 15, the Convention states that no modifications shall be made to the vessel's hull after the completion of the above article 14 surveys, without notifying first the vessel's flag administration.

In Article 16, the Convention states that the load line certification may be issued either by the vessel's flag or by a third-party instructed by same (such as a classification society).

On an international load line certificate, the vessel's freeboard from deck line and its load line is mentioned. In addition, the certificate indicates the vessel's allowance for every freeboard, except timber, as well as the limits of the deck line from which these freeboards are measured. Also, its plimsoll line is described.

7.3 CARGO SHIP SAFETY CONSTRUCTION CERTIFICATE

The cargo ship safety construction certificate is required for merchant vessels with 500 gross tonnes and more for international voyages (NAVREGS, 2016). The certification is a requirement described under the SOLAS chapters II-1, II-2, III, IV and V and chapter I, Part B: Surveys and certificates, regulation 10 (IMO, 2020). Regulation 10 of the SOLAS Convention refers to surveys that the vessel shall be subjected in order to acquire the safety construction certificate. The survey covers the examination of the vessel's structural condition and relevant equipment:

- Prior to the vessel's commissioning, an initial inspection shall be conducted to vessel's bottom area. Further to the vessel's bottom area, inspection shall include also the examination of the vessel's structure and machinery. In the examination process, surveyor will validate that the vessel's outfitting, steam production equipment and power production equipment are following the Convention's regulations. In case that the vessel is a tanker, additional examination shall be conducted regarding the condition of vessel's pumproom and piping arrangements.
- Certificate's renewal shall be issued on a 5-yearly period. Renewal survey's scope is to verify that all relevant equipment's and hull's items are complying with the regulations instructed by the Convention.
- An intermediate examination between vessel's second and third annual surveys shall be carried out to validate that the regulations of the Convention are being followed. The intermediate inspection includes the examination of vessel's machinery, electrical connections, steam production and maneuvering systems. In case that the vessel is a tanker, the survey also covers the examination of pumprooms and several piping arrangements.
- An annual inspection shall be carried out 90 days prior and 90 days after the vessel's anniversary date. The scope of the survey is an overall examination on the vessel's systems, verifying that the condition of each system is maintained properly as per Convention's suggestions.
- The Convention states that two inspections shall be carried out on the vessel's external bottom area at minimum.

7.4 CARGO SHIP SAFETY EQUIPMENT CERTIFICATE

The cargo ship safety equipment certificate is a document that covers the following:

- Firefighting equipment
- Lifesaving appliances
- Navigational equipment
- Sound and distress signals

The cargo ship safety equipment certificate is required for cargo ships with 500 gross tonnes and more for international voyages (NAVREGS, 2016). The certification is a requirement described under the SOLAS, Part B: Surveys and certificates, regulation 8 (IMO, 2020):

- An initial examination shall be conducted prior to the ship's commissioning, related to the vessel's lifesaving appliances, firefighting and navigational equipment. The Ship Safety Equipment Certificate does not include the radio equipment as same is covered in other certification. The survey covers the examination of the vessel's firefighting system and of the vessel's means of signals.
- A renewal examination for a 5-yearly time period. The scope of the survey is to validate that all systems covered under the Ship Safety Equipment Certificate are complying with the Convention's regulations.
- An annual inspection shall be carried out 90 days prior and 90 days after the vessel's anniversary date. The scope of the survey is an overall examination on the vessel's systems, verifying that the condition of each system is maintained properly as per Convention's suggestions.

An owner must appoint workshops approved by the vessel's classification society and its flag administration in order to proceed with the inspections. During the LSA survey the items covered are the following:

- Lifeboats
- Davits and winches
- Rescue boats
- Life rafts

The appointed workshop which is approved by the flag authority and the classification society issues a certificate validating that the condition of all the above is in good order and that the vessel may sail with subject equipment onboard. There are two kinds of LSA surveys: the annual and the 5-year. In the 5-year LSA survey the items for annual inspection are included and additionally the workshop performs lifeboat davits load tests.

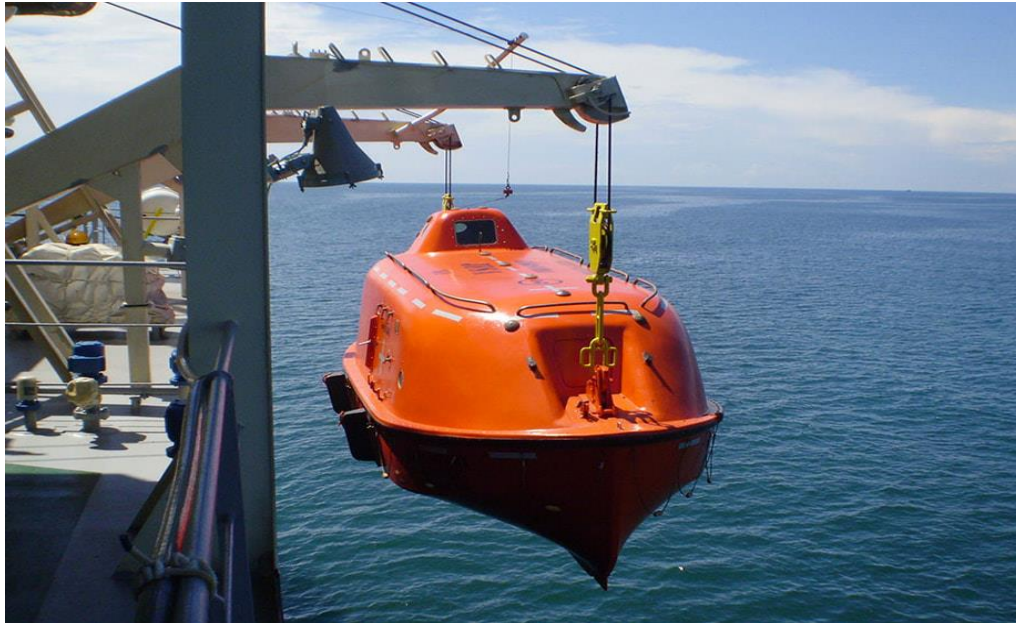


Figure 19: Lifeboat davit load test (Bureau Veritas, 2021)

For the firefighting equipment, which is included in the Cargo Ship Safety Equipment Certificate, the workshop which will perform the annual or the 5-year survey must also be approved by the vessel's classification society and flag administration. The items covered in the firefighting equipment survey are the following:

- Fire extinguishers
- Foam applicator
- Water mist
- Foam fixed system inside the engine room
- Foam analysis of fixed foam system
- Breathing apparatus
- Breathing apparatus compressor air quality test
- Fireman's outfit
- Medical oxygen
- Emergency escape breathing devices (EEBD's)
- Immersion suits
- Lifejackets

The 5-year survey includes all annual survey's items and additionally the hydrotesting of several fire fighting equipment system's such as breathing apparatus cylinders and the thorough service of the water mist system.



Figure 20: Fire extinguishers survey (Triton Group, 2021)

7.5 CARGO SHIP SAFETY RADIO CERTIFICATE

The Cargo Ship Safety Radio Certificate is indicating the vessel's radio equipment is being surveyed under the International Convention for The Safety Of Life At Sea (SOLAS) Chapter I regulation 9 requirements, detailed also in the SOLAS Chapter IV. The certification is a requirement for all vessels with 300 gross tonnes and above. For the certification of Cargo Ship Safety Radio Certificate, the below surveys should be conducted:

- An initial examination prior to the vessel's commissioning shall be carried out. The scope of the survey includes the verification that all radio equipment onboard the vessel (including radio equipment on the lifesaving appliances) is in compliance with the Convention's regulations.
- Certificate's renewal shall be issued on a 5-yearly period. Renewal survey's scope is to verify that all radio equipment onboard the vessel (including radio equipment on the lifesaving appliances) is in compliance with the Convention's regulations.
- An annual examination within 90 days before and 90 days after of the anniversary date of subject certification. The scope of the examination includes the verification that all radio equipment onboard the vessel (including radio equipment on the life saving appliances) is in compliance with the Convention's regulations.

Along with the Cargo Ship Safety Radio Certificate, a Record of Equipment for Cargo Ship Safety Radio (Form R) is provided. The Form R record contains information that the below listed equipment is surveyed:

<ul style="list-style-type: none"> 1 Primary systems 1.1 VHF radio installation: <ul style="list-style-type: none"> 1.1.1 DSC encoder 1.1.2 DSC watch receiver 1.1.3 Radiotelephony 1.2 MF radio installation: <ul style="list-style-type: none"> 1.2.1 DSC encoder 1.2.2 DSC watch receiver 1.2.3 Radiotelephony 1.3 MF/HF radio installation: <ul style="list-style-type: none"> 1.3.1 DSC encoder 1.3.2 DSC watch receiver 1.3.3 Radiotelephony 1.3.4 Direct-printing telegraphy 1.4 Recognized mobile satellite service ship earth station 2 Secondary means of alerting 	<ul style="list-style-type: none"> 3 Facilities for reception of maritime safety information <ul style="list-style-type: none"> 3.1 NAVTEX receiver 3.2 EGC receiver 3.3 HF direct-printing radiotelegraph receiver 4 Satellite EPIRB <ul style="list-style-type: none"> 4.1 COSPAS-SARSAT 5 VHF EPIRB 6 Ship's search and rescue locating device <ul style="list-style-type: none"> 6.1 Radar search and rescue transponder (SART) 6.2 AIS search and rescue transmitter (AIS-SART)
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Figure 21: Record of Equipment for Cargo Ship Safety Radio (Form R) list (ClassNK, 2021)

Also, the record indicates the methods used to ensure availability of radio facilities as per regulations IV/15.6 and 15.7, given below (IMO, 2020):

“SOLAS, Regulation IV 15.6 – on ships engaged on voyages in sea areas A1 and A2, the availability shall be ensured by using such methods as duplication of equipment, shore-based maintenance or at-sea electronic maintenance capability, of a combination of these, as may be approved by the administration.”

“SOLAS, Regulation IV 15.7 – on ships engaged on voyages in sea areas A3 and A4, the availability shall be ensured by using a combination of at least two methods such as duplication of equipment, shore-based maintenance or at-sea electronic maintenance capability, as may be approved by the administration, taking into account the recommendation of the organization.”



Figure 22: Service and test of radio equipment: EPIRBs and GMDSS (Aeromarine SRT, 2021)

7.6 INTERNATIONAL OIL POLLUTION PREVENTION CERTIFICATE

The international oil pollution prevention certificate is issued under the International convention for the prevention of pollution from ships (1973). The certification verifies that:

- The vessel is examined following the regulations of Annex I of the Convention and
- The vessel's structure, equipment, fittings, systems, arrangement and materials all found in satisfactory condition and the vessel complies with Annex I requirements

Annex I- Regulations for the Prevention of Pollution by Oil is given below (MARPOL, 2021):

According to the regulation 6 of the Convention, all vessels with 400 gross tonnage and above and all tankers with 150 gross tonnage and above shall be subjected to the below surveys:

- Prior to the vessel's commissioning, an initial inspection shall be conducted to vessel's equipment and structure. In the examination process, surveyor will validate that the vessel's equipment and structure are following the Convention's regulations.
- Certificate's renewal shall be issued on a 5-yearly period. Renewal survey's scope is to verify that all relevant equipment is complying with the regulations instructed by the Convention.

- An intermediate examination between vessel's second and third annual surveys shall be carried out to validate that the regulations of the Convention's Annex are being followed. The intermediate inspection includes the examination of vessel's pumping and piping arrangements as well as the oil discharging systems and the oil water separator arrangement.
- An annual inspection shall be carried out 90 days prior and 90 days after the vessel's anniversary date. The scope of the survey is an overall examination on the vessel's systems, verifying that the condition of each system is maintained properly as per the Annexes' suggestions.

According to the regulation 7 of the Convention, after the completion of initial and renewal examinations, an International Oil Pollution Prevention certificate shall be issued accordingly. The regulation refers to the vessels with a gross tonnage of 400 tonnes or above and/or tankers with a gross tonnage of 150 tonnes and above, calling the ports under the jurisdiction of the flag administrations which are complying with the Convention. Also, the Convention states that the certification shall be issued either by the vessel's flag administration or by an organization instructed by same.

In addition to the International Oil Pollution Prevention Certificate (IOPP certificate), Annex I requires the issuance of a supplement document called Record of Construction and Equipment for Ships Other Than Oil Tankers. This record, together with the initial IOPP certification, must be retained onboard at all times. The following details are included in the file:

- Ship's particulars
- Equipment of oil discharge control from bilges and fuel oil tanks inside machinery areas
- Means of sludge disposal (as per regulation 12)
- Discharge connection methods (as per regulation 13)
- Emergency plan for marine pollution (as per regulation 37)

7.7 INTERNATIONAL AIR POLLUTION PREVENTION CERTIFICATE

The International Air Pollution Prevention Certificate is a documentation ensuring that every vessel with 400 gross tonnes and above is in accordance to MARPOL's Annex VI – Regulations for the Prevention of Air Pollution from Ships (MARPOL training, 2017).

Any intentional releases of ozone-depleting chemicals are forbidden. Except for minor releases linked with the recapture or recycling of an ozone-depleting material, purposeful emissions include those emissions that are been generated once a system is

repaired or maintained. Parties to the 1997 Protocol may restrict emissions resulting from ozone-depleting substance leaks, whether the leaks are deliberate.

The International Air Pollution Prevention Certificate also applies for Nitrogen oxides (NO_x), regarding vessel's engines that were installed from 1st of January 2000 and after. From the certificate's scope the following engines are excluded:

- Emergency diesel engines
- Engines installed on the vessel's lifeboats
- Engines subject to an alternative nitrogen oxides control measure approved by the flag Administration, engines placed on ships that are trading in routes under the authority of the vessel's flag administration
- Every other equipment that will be used only in case of emergency

The regulation and therefore the certification prohibits the operation of any diesel engines, except those which are within some limits, set out by the convention in accordance with the Nitrogen oxides (NO_x) Technical Code. Also, for engines consuming hydrocarbon blends derived from petroleum refining, testing and measurement procedures shall comply with relevant NO_x Technical Code.

The diesel engine's operation is allowed either by:

- A system cleaning the exhaust gases is installed on the vessel, as long as subject system is approved by the flag administration and in accordance with the Nox Technical Code, reducing NO_x emissions to the specified limits or;
- An equivalent method, approved by the flag administration, which reduces the Nox emissions to the desired limits

In addition to the ozone -depleting chemicals and the nitrogen oxides (NO_x), the regulation sets a maximum limit to the sulphur oxides (Sox) too. Particularly, any fuel oil used onboard each vessel should not exceed the cap of 4.5% m/m. The Organization will monitor the global average sulphur content of residual fuel oil supplied for use on board ships, based on rules that will be set, so the current sulphur oxides' cap is subject to change.

As per MARPOL Annex VI, Chapter 3, vessels sailing to the North American Sea, the United States Caribbean Sea, the Baltic Sea and the North Sea shall use fuel oil with sulphur content not exceeding the can of 1.5% m/m (IMO, 2014).

In addition to the above requirement, MARPOL sets another restriction in Chapter 3, Regulation 14(4)(b):

“an exhaust gas cleaning system, approved by the Administration taking into account guidelines to be developed by the Organization, is applied to reduce the total emission of sulphur oxides from ships, including both auxiliary and main propulsion engines, to 6.0 g SO_x/kW·h or less calculated as the total weight of sulphur dioxide emission. Waste streams from the use of such equipment shall not be discharged into enclosed ports, harbours and estuaries unless it can be thoroughly documented by the ship that such waste streams have no adverse impact on the ecosystems of such enclosed ports, harbours and estuaries, based upon criteria communicated by the authorities of the port State to the Organization. The Organization shall circulate the criteria to all Parties to the Convention” (MARPOL training, 2017)

The certificate will be required prior to the vessel’s first voyage. This inspection must validate that all systems meet the applicable standards of this Annex. To ensure that the vessel’s equipment is in compliance with the applicable regulations of this Annex, a 5-yearly renewal examination shall be conducted, under the flag Administration’s instructions. In case of a malfunction on a system relevant to the certificate, the survey must ensure that all required rectifications or new installations have been effectively restored, with materials found to be satisfactory, and that the vessel is complying once again with the requirements of this Annex in all respects.

In addition to the International Air Pollution Prevention Certificate, a supplement certificate is also issued, indicating the specifications of each vessel’s engines regarding the requirements of the nitrogen oxides (NO_x). The supplement also validates that vessel complies with the sulphur oxides’ (SO_x) requirements, indicating the fuel oil sulphur content used by the vessel.

7.8 INTERNATIONAL ENERGY EFFICIENCY CERTIFICATE

The International Energy Efficiency Certificate (IEEC) is a requirement after the adoption of resolution MEPC.203(62) which includes regulations for energy efficiency for ships in MARPOL Annex VI. Those regulations came into effect on 1/1/2013 and are applicable to all vessels with 400 gross tonnes and above.

The International Energy Efficiency Certificate (IEEC) is issued for both newbuilding and vessels already in service. In the first occasion, the certification is issued during the

initial survey while for the second case this statutory certificate is issued during either vessel's intermediate or renewal survey. The certificate is issued once for every vessel (Human Environment and Transport Inspectorate (Ministry of Infrastructure and Water Management), 2021).

For the issuance of the International Energy Efficiency Certificate (IEEC), the attending classification society's surveyor will validate that the vessel is in compliance with the below regulations, as stated in the Annex VI of the International Convention for the Prevention of Pollution from ships:

- Regulation 20: Attained Energy Efficiency Design Index (EEDI), an index showing the energy efficiency calculation results for a particular vessel
- Regulation 21: Required Energy Efficiency Design Index (EEDI), an index showing the energy efficiency for the particular vessel's type allowance limit
- Regulation 22: Ship Energy Efficiency Management Plan (SEEMP), a plan designed from the ship owners, which aims to measure and improve the vessel's energy efficiency in operation

7.9 INTERNATIONAL SEWAGE POLLUTION PREVENTION CERTIFICATE

The Annex IV of MARPOL sets several regulations to the vessels' sewage discharge into the sea. With those regulations the health hazard from the discharging of raw sewage can be eliminated. Also, with this limitation the oxygen depletion that can create visual pollution on coastal areas can be terminated, giving a solution to the cities which are based in the tourist industries.

Annex IV comprises several rules governing the discharging of sewage in the waters by vessels, containing rules governing the vessel's machinery and arrangements for sewage discharging control, the provision of sewage port reception facilities, and survey and certification requirements (IMO, 2021). The oceans are thought to be capable of digesting and dealing with untreated sewage on the high seas through natural bacterial action. As a result, unless otherwise indicated, the provisions in Annex IV of MARPOL forbids the sewage discharging in the waters between a defined mileage from the shore. Thus, the governments of the countries with ports must provide to each vessel the facilities for the reception of the sewage, facilities capable enough not to cause any delay to their operation schedule.

The updated Annex applies to vessels with 400 gross tonnes or above, certified in carrying more than 15 people on international voyages. Vessels must have an approved by the flag administration and the classification society sewage treatment plant, an approved sewage and disinfection system, or a sewage holding tank, according to the Annex.

Discharging sewage into the sea is forbidden unless the ship is operating an approved sewage treatment plant or is discharging and disinfected sewage using an approved method more than three nautical miles from the nearest land. When the vessel is underway, travelling with more than 4 knots, untreated sewage can be released 12 nautical miles and above of the closest land and the discharging rate should be instructed by the Administration (as per MEPC.157(55)).

The International Sewage Pollution Prevention Certificate (ISPP) is ensuring that the sewage treatment system is operating in good working order. Also, on the certificate the sewage treatment plant type and name of manufacturer is mentioned, along with the vessel's particulars. The surveys required for the certificate's issuance are the below:

- Initial examination prior to the issuance of the International Sewage Pollution Prevention Certificate or prior to the ship's operation commencement
- Renewal survey in case the certificate is issued, not exceeding the 5-year time period.

7.10 INTERNATIONAL BALLAST WATER MANAGEMENT CERTIFICATE

Invasive aquatic organisms pose a significant hazard to marine ecosystems, and shipping has been identified as a primary route for bringing species to new areas. The problem worsened as commerce and traffic volumes increased over the last few decades, especially with the development of steel hulls, which allowed ships to use water as ballast instead of solid items. The consequences of introducing new species have been severe in many parts of the planet. The rate of bio-invasions is continuing to rise at an alarming rate, according to quantitative statistics. The situation may not have reached its apex yet, since the volume of seaborne trade continues to grow (IMO, 2021).

In 2004, the Ballast Water Management Convention adopted and has set out management, control guidelines and procedures for the vessels' ballasting arrangements, so as to achieve the prevention of harmful aquatic organisms spreading to foreign marine environments.

According to the convention, all vessels operating in an international trade are obliged to have the below documentation on board (ClassNK, 2021):

- Management plan for ballast water and sediments (BMWP)
- Ballast water record book (BWRB)
- International ballast water management certificate (IBWMC)

The Ballast Water Management Convention (BWM, 2004) suggests in section D two methods for the proper management of the ballast water:

“Regulation D-1 Ballast Water Exchange Standard - Ships performing Ballast Water exchange shall do so with an efficiency of 95 per cent volumetric exchange of Ballast Water. For ships exchanging ballast water by the pumping-through method, pumping through three times the volume of each ballast water tank shall be considered to meet the standard described. Pumping through less than three times the volume may be accepted provided the ship can demonstrate that at least 95 percent volumetric exchange is met.

Regulation D-2 Ballast Water Performance Standard - Ships conducting ballast water management shall discharge less than 10 viable organisms per cubic metre greater than or equal to 50 micrometres in minimum dimension and less than 10 viable organisms per millilitre less than 50 micrometres in minimum dimension and greater than or equal to 10 micrometres in minimum dimension; and discharge of the indicator microbes shall not exceed the specified concentrations.” (IMO, 2021)

In order for the requirement of the regulation D-2 to be achieved, a ballast water treatment system is required to be installed onboard. The ballast water treatment system shall be approved by the flag administration and the classification society in order to be installed onboard. Prior to the initial ballast water management certificate survey, the owner of the vessel shall provide to the classification society relevant drawings, indicating the pipeline and electronic cabling arrangements of the ballast water treatment system, subject to classification society’s approval. Once the approval is granted, then the classification society’s surveyor shall attend the vessel, inspect the ballast water treatment system’s operation (along with the witnessing of the ballast water treatment system’s maker’s representative) and validate that all relevant documentation is kept onboard. Once all parameters are successfully validated, the classification society’s surveyor shall issue the initial international ballast water management certificate (IBWMC), subject to approval to the flag administration. The

flag administration will then issue a full-term international ballast water management certificate, which includes the below information:

- Vessel's particulars
- Vessel's principal ballast water management methods (D-1 and in case D-2 is applied, then the type and model of the ballast water treatment system is indicated)
- Validity of the certification (subject to surveys in accordance with regulation E-1 of the Annex to the Convention)

According to the Annex-Section E of the Convention, the international ballast water management certificate consists of the initial renewal survey and an annual, an intermediate and a renewal survey. Related appendices will be included to the full-term international ballast water management certificate, issued by the flag administration.

7.11 INTERNATIONAL ANTI-FOULING SYSTEM CERTIFICATE

Lime and subsequently arsenic were used to coat the hulls of sailing ships until the contemporary chemical industry produced efficient anti-fouling paints based on metallic compounds. Barnacles and other marine creatures that have latched themselves to the ship slowly "leach" into the sea water, destroying them. However, investigations have revealed that these substances persist in the water, killing sea life, causing environmental damage, and possibly entering the food chain. The organotin tributyltin (TBT), which has been demonstrated to cause deformations in oysters and sex changes in whelks, is found in one of the most efficient anti-fouling paints produced in the 1960s. (IMO, 2021)

According to the terms of the International Convention on the Control of Harmful Anti-Fouling Systems on Ships (2001), the use of harmful organotin in anti-fouling paints which the vessels use for coating to prevent the attaching of various sea organisms (algae, molluscs) resulting to the reduction of the vessel's speed in voyage and therefore the increase of the fuel consumption, is prohibited.

The vessels flying the flag or operate under the authority of a party or entering a shipyard or a port of this party of the Anti-Fouling System (AFS) Convention, is not allowed to use such harmful anti-fouling systems. Those systems are included in the Convention's Annex, which is being updated on regular basis.

The scope of the International Anti-Fouling System Certificate is to certify that the vessel's anti-fouling system is complying with relevant rules and regulations of the International Convention on the Control of Harmful Anti-Fouling Systems on Ships (2001). The certificate is issued by the classification society and a survey shall be carried out each time the vessel changes or replaces its anti-fouling system. In case of minor repairs on vessel's hull have been occurred, a survey is not considered necessary. However, in case that the repairs are affecting an area of 25 percent of the anti-fouling system's area, a survey shall be carried out and if necessary, a new anti-fouling certificate shall be renewed. Once a survey is requested by the owner of the vessel, apart from the vessel's specification, further information for the anti-fouling system is required, provided either by the owner or the anti-fouling system manufacturer. The below information shall be given to the classification society (IMO, 2010):

- Anti-fouling system's type
- Manufacturer's name
- Systems type and colour
- Active ingredients and their CAS numbers (Chemical Abstract Service Registry Number)

7.12 DOCUMENT OF COMPLIANCE, SPECIAL REQUIREMENTS FOR SHIPS CARRYING DANGEROUS GOODS CERTIFICATE

According to the International Convention for the Safety of Life at Sea (1974) Chapter II – Regulation 19, a vessel may carry goods considered dangerous if the below conditions are being followed (IMO, 2020):

- Additional fire fighting equipment must be supplied onboard the vessel, both for the vessel's crew (personnel protective equipment) and installed systems, in order for the vessel to be protected in case there is a hazard during the loading and carriage of those goods
- The cargo holds and relevant cargo must be protected and at distance from items that can cause fire ignition
- Sufficient water supply both in proper quantity and pressure, required in case of a fire outbreak
- Proper drainage systems both for the water that will extinguish the potential fire or for toxic cargo fluids
- Fire detecting systems installation inside the cargo spaces
- Arrangements for the air renewal inside the cargo space, provided by a ventilation system (such as electrical fan)
- Proper insulation installations between the areas of machinery and cargo holds

Further to the above listed requirements, the vessel must comply also to the International Maritime Dangerous Goods (IMDG) Code and the International Maritime Solid Bulk Cargoes (IMSBC) Code to be credited with certification of the carriage of such goods.

Once a commencement inspection is complete, the certification is endorsed on an annual basis, and a renewal examination shall be conducted 5 years after the initial certification issuance.

The dangerous goods are classified under the following categories:

- Class 1 – Explosives
- Class 2 – Gases : compressed, liquefied or dissolved under pressure
- Class 3 – Flammable* liquids
- Class 4.1 – Flammable* solids
- Class 4.2 – Substances liable to spontaneous combustion
- Class 4.3 – Substances which, in contact with water, emit flammable gases
- Class 5.1 – Oxidizing substances
- Class 5.2 – Organic peroxides
- Class 6.1 – Toxic substances
- Class 6.2 – Infectious substances
- Class 7 – Radioactive materials
- Class 8 – Corrosive substances
- Class 9 – Miscellaneous dangerous substances and articles, i.e. any other substances which experience has shown, or may show, to be of such a dangerous character that the provisions of this part shall apply to it.

Figure 23: Dangerous goods classes list (ClassNK, 2022)

In addition to the dangerous goods classes, a vessel's Document of Compliance – Special Requirements for Ships Carrying Dangerous Goods Certificate indicates a list with dangerous cargoes that the vessel can carry. This list also includes the following information (ClassNK, 2022):

- Each cargo class
- United Nations (UN) number, a four-digit number that indicates the hazardous chemical code
- The cargo holds numbers that can be loaded with the specific dangerous cargo
- Notes, if applicable, for each dangerous cargo

7.13 POLAR SHIP CERTIFICATE

IMO's International Code for Ship's Operating in Polar Waters (Polar Code) came into effect on January 1st, 2017, implemented by both the International Convention for the

Prevention of Pollution from Ships (MARPOL) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 2017) The Polar Code applies to the vessels on domestic or international voyages trading in Arctic Area or Antarctic Area which according to the code are considered Polar Waters (DNV-GL, 2017).

The implementation dates for Polar Code are the below:

- Part 1 is referring to the safety and training requirements for vessels operating in Polar Areas in accordance with the SOLAS convention
- Part 2 is referring to the protection of the environment of Polar Areas in accordance with the MARPOL convention

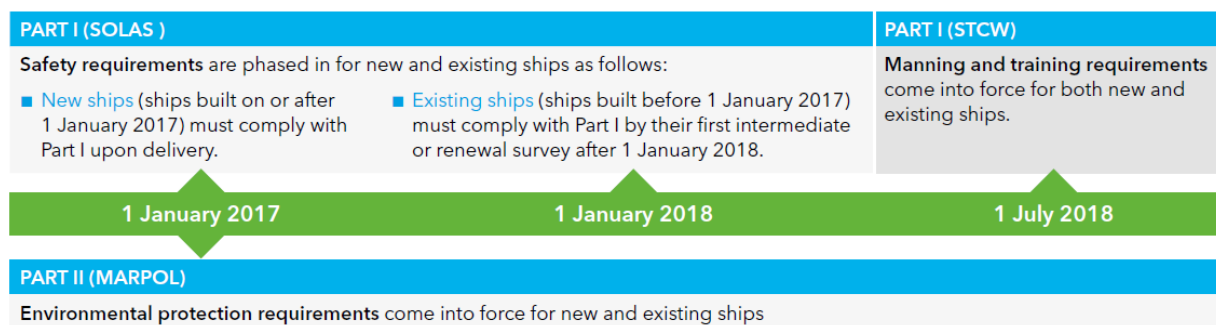


Figure 24: Implementation dates for the Polar Code (DNV-GL, 2017)

In order for the vessel to operate in Polar Areas, the vessel's owner or manager shall take several actions to ensure that the vessel's documentation is complying with the Polar Code. Those actions are listed below:

Part 1 SOLAS

- Polar Ship Certificate shall be available onboard
- Polar water operation manual shall be developed and be available onboard
- Reference to the STCW and Polar Code no.12, vessel should have available onboard the appropriate training certificate issued by the vessel's relevant flag administration
- Reference to the Polar Code no.11, vessel shall initiate voyage planning prior to the vessel's voyage, as instructed by the polar water operational manual (PWOM)

Part 2 MARPOL

- The vessel should have available onboard relevant pollution prevention documentation, updated by the operational requirements for polar areas, including also instructions implemented by MARPOL convention's chapters I, II, IV and V.

The vessels certified by SOLAS convention and operating in polar waters, should carry relevant Polar Ship Certificate. This certification is issued by the flag state or an authorized classification society. The surveyor who will contact the inspection, may validate that the vessel is operating and complying with Part 1 SOLAS convention requirements. Additionally, the owner shall provide to the attending surveyor the below documentation and information:

- Risk assessment (RA) for the operation of the vessel in polar waters

- Polar Water Operational Manual (PWOM) produced for the vessel's particulars and specifications

The surveyor who will attend the vessel in order to issue the Polar Ship Certificate, will inspect the following (DNV-GL, 2017):

- i. The vessel complies to the requirements of safety related provisions of the International Code for Ships Operating in Polar Waters
- ii. The vessel complies with the requirements of Polar Code related to its structure, radio station arrangements, fittings, equipment and materials
- iii. The polar ship category:
 - a. Category A – This category includes the vessels which are built in accordance with the IACS Polar ice classes PC1 to PC5 (depending on the operating capability of operation in polar waters and the ice's condition, which at least contains old ice inclusions)
 - b. Category B – This category includes the vessels which are built in accordance with the IACS Polar ice classes PC6 and PC7 and are not included in Category A. This category is referring to vessels operating in at least thin ice conditions
 - c. Category C - This category includes the vessels which are designed to operate in mild ice conditions and in open water, not listed in categories A and B
- iv. Operational limitations, if applicable, indicating the restrictions of the vessel's operation in polar waters

The Polar Ship Certificate will be accompanied with the Record of Equipment (Form PS), which should be complying with the International Code for Ships Operating in Polar Waters. The record of equipment includes:

<i>2.1 Life-saving appliances</i>		<i>2.3 Communication equipment</i>	
1	Total number of immersion suits with insulation	1	Sound signaling system mounted to face astern to indicate escort and emergency manoeuvres to following ships as described in the International Code of Signals (for ships intended to provide ice breaking escort)
1.1	for crew	2	Voice and/or data communications with relevant rescue coordination centres
1.2	for passengers	3	Equipment for voice communications with aircraft on 121.5 and 123.1 MHz
2	Total number of thermal protective aids	4	Two-way voice and data communication with a Telemedical Assistance Service (TMAS)
3	Personal and Group Survival Equipment	5	All rescue boats and lifeboats, whenever released for evacuation, have a device (for ships certified to operate in low air temperature)
3.1	Personal survival equipment – for number of persons	5.1	for transmitting vessel to shore alerts
3.2	Group survival equipment – for number persons	5.2	for transmitting signals for location
3.3	Total capacity of liferafts in compliance with chapter 8 of the Polar Code	5.3	for transmitting and receiving on-scene communications
3.4	Total capacity of lifeboats in compliance with chapter 8 of the Polar Code	6	All other survival craft have a device
<i>2.2 Navigation equipment</i>		6.1	for transmitting signals for location
1	Two independent echo-sounding devices or a device with two separate independent transducers	6.2	for transmitting and receiving on-scene communications
2	Remotely rotatable, narrow-beam search lights controllable from the bridge or other means to visually detect ice		
3	Manually initiated flashing red light visible from astern (for ships involved in icebreaking operations)		
4	Two or more non-magnetic independent means to determine and display heading		
5	GNSS compass or equivalent (for ships proceeding to latitudes over 80 degrees)		

Figure 25: Record of equipment for the Polar Ship Certificate (From PS) list (ClassNK, 2021)

7.14 INVENTORY OF HAZARDOUS MATERIALS CERTIFICATE

Several years ago, it has been noticed that during the vessels' recycling procedures, several health and environmental hazards were generated, causing concerns about the effects of the recycled materials both in the environment but also to human health.

Due to this fact, in 2009, the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships came into effect (IMO, 2022), providing regulations for safe materials' use onboard the vessels, from their beginning of their construction to their recycling. In this respect, the recycling effects both on environment and human life are within safe levels.

The Inventory of Hazardous Materials (IHM) contains a list with the quantity and number of hazardous materials located onboard the vessels that are either in vessel's construction, on wastes during vessel's operation or in vessel's stores.

According to the European Union's Ship Recycling Regulation (EU SRR) (European Parliament, 2013), all newbuilding vessels carrying a European member's flag should be commissioned with an issued Inventory of Hazardous Materials list and certificate accordingly. Also, all vessels heading to recycling, should carry a valid Inventory of Hazardous Materials certificate and should be recycled on recycling yard which is authorized by the European Union's regulations. Finally, as per European Union's Ship Recycling Regulation (EU SRR), after 31 December 2020, all vessels carrying a European member's flag or any vessels under a non-European member's flag, calling

any of the European Union's port, should hold a validated Inventory of Hazardous Materials (IHM) certification.

In order for the Inventory of Hazardous Materials (IHM) list to be prepared, the following process need to be followed:

- For newbuilding vessels, the party who must prepare and issue relevant certification is the exclusive shipyard, where the vessel is being constructed
- For vessels already in service, the party responsible who must prepare, and issue relevant certification is the owner, who need to proceed with the following:
 - o Gather and evaluate status of the materials onboard
 - o To arrange attendance of Hazmat experts, approved by the vessel's flag administration and classification society, in order for the sampling process to be commenced
 - o The Hazmat experts shall dispatch relevant samples for examination in certified laboratories and proceed with the final IHM report
- After IHM report is completed, the owner must request from the vessel's classification society to validate and authorize the IHM report
- Upon completion of the approval by the vessel's classification society, a surveyor shall be arranged in order to conduct the initial Inventory of Hazardous Materials survey and issue relevant certification, lasting for 5 years

There are 3 parts of the Inventory of Hazardous Materials (DNV, 2022). The first part refers to the certification of either a newbuilding vessel or a vessel already in service. This certificate shall always be onboard and shall be updated when necessary. The IHM parts 2 and 3 are mandatory only once a vessel is heading to recycling. Below figures indicate the European Union's SRR Annex I and II the hazardous materials for examination (European Parliament, 2013):

ANNEX I

CONTROL OF HAZARDOUS MATERIALS

Hazardous Material	Definitions	Control measures
Asbestos	Materials containing asbestos	For all ships, new installation of materials which contain asbestos shall be prohibited.
Ozone-depleting substances	<p>Controlled substances defined in Article 1(4) of the Montreal Protocol on Substances that Deplete the Ozone Layer, 1987, listed in Annexes A,B,C or E to that Protocol in force at the time of application or interpretation of this Annex.</p> <p>Ozone-depleting substances that may be found on board ships include, but are not limited to:</p> <p>Halon 1211 Bromochlorodifluoromethane</p> <p>Halon 1301 Bromotrifluoromethane</p> <p>Halon 2402 1,2-Dibromo-1,1,2,2-tetrafluoroethane (also known as Halon 114B2)</p> <p>CFC-11 Trichlorofluoromethane</p> <p>CFC-12 Dichlorodifluoromethane</p> <p>CFC-113 1,1,2-Trichloro-1,2,2-trifluoroethane</p> <p>CFC-114 1,2-Dichloro-1,1,2,2-tetrafluoroethane</p> <p>CFC-115 Chloropentafluoroethane</p> <p>HCFC-22</p> <p>Chlorodifluoromethane</p>	New installations which contain ozone-depleting substances shall be prohibited on all ships.
Polychlorinated biphenyls (PCB)	'Polychlorinated biphenyls' means aromatic compounds formed in such a manner that the hydrogen atoms on the biphenyl molecule (two benzene rings bonded together by a single carbon-carbon bond) may be replaced by up to ten chlorine atoms	For all ships, new installation of materials which contain Polychlorinated biphenyls shall be prohibited.
Perfluorooctane sulfonic acid (PFOS) ⁽¹⁾	'perfluorooctane sulfonic acid' (PFOS) means perfluorooctane sulfonic acid and its derivatives	New installations which contain perfluorooctane sulfonic acid (PFOS) and its derivatives shall be prohibited in accordance with Regulation (EC) No 850/2004 of the European Parliament and of the Council ⁽²⁾ .
Anti-fouling compounds and systems	Anti-fouling compounds and systems regulated under Annex I to the International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (AFS Convention) in force at the time of application or interpretation of this Annex.	1. No ship may apply anti-fouling systems containing organotin compounds as a biocide or any other anti-fouling system whose application or use is prohibited by the AFS Convention.

Figure 26: Control of hazardous materials, Annex I (European Parliament, 2013)

Hazardous Material	Definitions	Control measures
		2. No new ship or new installations on ships shall apply or employ anti-fouling compounds or systems in a manner inconsistent with the AFS Convention.

⁽¹⁾ Not applicable for ships flying the flag of a third country.

⁽²⁾ Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC (O) L 158, 30.4.2004, p. 7).

Figure 27: Control of hazardous materials, Annex I-b (European Parliament, 2013)

ANNEX II

LIST OF ITEMS FOR THE INVENTORY OF HAZARDOUS MATERIALS

1. Any hazardous materials listed in Annex I
2. Cadmium and Cadmium Compounds
3. Hexavalent Chromium and Hexavalent Chromium Compounds
4. Lead and Lead Compounds
5. Mercury and Mercury Compounds
6. Polybrominated Biphenyl (PBBs)
7. Polybrominated Diphenyl Ethers (PBDEs)
8. Polychlorinated Naphthalenes (more than 3 chlorine atoms)
9. Radioactive Substances
10. Certain Shortchain Chlorinated Paraffins (Alkanes, C10-C13, chloro)
11. Brominated Flame Retardant (HBCDD)

Figure 28: List of items for the inventory of hazardous materials, Annex II (European Parliament, 2013)

7.15 INTERNATIONAL TONNAGE CERTIFICATE

The international tonnage certificate is a required certification which came into force after the International Convention of Tonnage Measurement of Ships, in 1969 (IMO, 2022). The scope of the convention back in 1969, was to create a universal formula in calculating the tonnage of each vessel. Before the convention, there were many variations in calculating a vessel's tonnage and the ports could not verify if the stated tonnage of each vessel depicts the vessel's real tonnage. In order to minimize the variations of the tonnages for each vessel, the convention decided that all merchant vessels shall have their tonnage calculated by an independent authority and in this case,

the convention itself. The tonnage measurement is used to calculate the charges of the port dues, the taxes of a shipping company and also to determine the minimum safety guidelines of vessels, due to the fact that all certificates are valid for a determined gross tonnage unit and above or below.

The gross tonnage is a calculation based on the sum of every enclosed space's volume on a vessel. In a gross tonnage calculation, all spaces are considered, such as the bridge, the emergency generator room, accommodation decks, funnel and hatch covers. Once all enclosed spaces that are not used for "revenue earning" are deducted from the gross tonnage, then the calculation determines the net tonnage. Therefore, the gross tonnage includes only the cargo holds of a vessel. The international tonnage certificate is issued upon vessel's delivery (after its construction). The certificate can be amended only in case that a tonnage survey is conducted.

7.16 REGISTER OF LIFTING APPLIANCES

The register of lifting appliances and items of loose gear is a requirement under the provisions of the International Labor Organization's Convention No.152 (ILO Convention, 1985). The scope of the convention's regulation is to ensure that all vessels are complying with all safety precautions regarding the cargo handling appliances. Those appliances can be either ship's cargo cranes or cranes with smaller capacity, located inside the engine room area or on deck, used for the connection of the bunkering hose and provisions loading. The cargo handling appliances survey is always listed in a vessel's class status, and it is compulsory to be surveyed annually. The attending surveyor will examine thoroughly each crane's condition and wiring visually. The loose gear (web slings, hooks) of each crane is also inspected for damages or excessive wear and rust. Once every five years, the classification society's surveyor will have to witness for each vessel's crane a load test, verifying that way that the crane is still operational and under safe usage.

<u>SWL</u>	<u>Test load</u>
Up to 20 tonnes	25 per cent in excess
20 to 50 tonnes	5 tonnes in excess
Over 50 tonnes	10 per cent in excess

Figure 29: Cranes safe working load tests (ILO Convention, 1985)

The cargo handling gear initial certificate is issued once a vessel is constructed. Afterwards, the certificate shall be endorsed on an annual basis. The certification can be amended in case there is a damage on the crane. Once the damage is occurred, the vessel's owner or manager shall notify the classification society and the flag administration in time. The certificate's renewal is required on a five-year basis, along with the cargo handling gear's load testing requirement.

7.17 INTERNATIONAL SAFETY MANAGEMENT CERTIFICATE

The international safety management certificate came into force on 1988, under SOLAS Chapter IX ((RINA, 2022). In regulation 1 of Chapter IX of SOLAS, a brief definition is given regarding to the International Safety Management Code (ISM Code), the company, which may be either the owner of a vessel or a ship manager and each of a vessel's type covered under the ISM code.

The International Safety Management Code (ISM Code) was revised on 1st of January 2015 (ClassNK, 2015). The Code's full title is International Management Code for the Safe Operations of Ships and for Pollution Prevention. The main objectives of the ISM Code are summarized below:

“to ensure safety at sea, prevention of human injury or loss of life, and avoidance of damage to the environment, in particular to the marine environment, and to property.” (ClassNK, 2015)

Furthermore, the ISM Code is setting minimum safety standards to each owning or managing company:

- “provide for safe practices in ship operation and a safe working environment
- assess all identified risks to its ships, personnel and the environment and establish appropriate safeguards
- continuously improve safety-management skills of personnel ashore and aboard ships, including preparing for emergencies related both to safety and environmental protection.” (ClassNK, 2015)

In order for a company to comply with the ISM Code's regulations, it has to create a safety-management system, verifying the following (ClassNK, 2015):

- Compulsory regulations are being followed, either by the vessel's crew or the personnel ashore
- All guidelines required by the flag administration, the IMO and the classification societies are being taken into consideration

If the above requirements are met, then a company owning or managing a vessel, or a fleet shall be certified for being in compliance with the ISM Code's guidelines. This certification is called Document of Compliance (DOC) and can be issued either by the Flag Administration or an authorized classification society. On the certification, the company's name, address, identification number and the owning or managing vessels' type are indicated. The Document of Compliance shall be always available onboard and in case needed, master shall provide it to the authorities requesting it (IMO, 2020). To issue a company's Document of Compliance, the company has to collect all required documentation for its safety management system and submit it to the classification society and the flag administration. Once reviewed by the authorized classification society, an interim audit shall be conducted. If the audit is successfully completed, the interim Document of Compliance is issued with one year validity. Prior to the interim Document of Compliance certification's expiry, the company shall request for the classification society to carry out an initial audit. If the initial audit is completed successfully, the company will grant a full-term Document of Compliance, valid for the next five years. The full-term Document of Compliance shall be endorsed on an annual

basis (four annual audits) and after the five years validity, company shall request again to the authorized classification society for a renewal audit.

Upon receiving the Document of Compliance, the ship owning or managing company can request from an authorized by the flag administration classification society to carry out an interim audit, in order to issue the Safety Management Certificate (SMC), which will have a six-month validity. Once the six-month due date is approaching, the company can conduct the initial audit for the issuance of a full-term Safety Management Certificate (SMC), with a validity of five years. The full-term certificate shall be examined on the third year with an intermediate audit and after five years from the first issue date with a renewal audit (RINA, 2022).

7.18 INTERNATIONAL SHIP SECURITY CERTIFICATE

The International Ship and Port Facility (ISPS) Code came into force on 1st of July 2004, under the regulations of SOLAS Chapter XI-2, in order to set security standards to all concerned parties (company, vessel's crew, port authorities and governments) in case of a security related matter. The ISPS Code consist of 2 parts, Part A is mandatory and Part B recommendatory and applies to all vessels with a gross tonnage of 500 and above (for merchant vessels) and all passenger vessels (IMO, 2022).

To secure the vessel, the crew and the port authorities, the ISPS Code set out the following:

- Ship Security Assessment (SSA): The identification of potential threats, weaknesses and existing control measures onboard the vessel (Bureau Veritas, 2022).
- Ship Security Plan (SSP): An emergency response plan shall be always available, providing necessary actions taken by the vessel's crew and ashore personnel in case of a possible threat, such as piracy or war attacks.
- Company Security Officer (CSO): A person appointed by the ship owning or managing company, responsible for the implementation of the ship security plan and also the amendment of same in case required by the ISPS Code.
- Ship Security Officer (SSO): A person appointed by the company security officer to implement the ship security plan onboard the vessel. Usually, the ship security officer is the master of the vessel. The ship security officer shall perform on regular basis security drills with the crew and also appoint and advise the role of each member in case of an emergency, in accordance with the particular ship security plan.
- Ship Security Alert System (SSAS): The security equipment that will be needed in case of an emergency. The equipment consists of a long-range identification tracker (LRIT) and hidden alarm and alert mechanisms.

Upon all required documentation and actions completion, the company shall request from an authorized (by the flag administration) classification society to review and approve the Ship Security Assessment (SSA) and the Ship Security Plan (SSP). Once

the required documentation is approved, an onboard examination will be conducted, and an interim International Ship Security Certificate (ISSC) will be issued. This certification will indicate the vessel's information and validate that the security system and equipment onboard the vessel is complying with the ISPS Code and the SOLAS Chapter XI-2 regulations. The interim certificate's valid period is six months. Prior to the interim certification's expiry date, owners or managers shall request from the classification society an initial inspection onboard the vessel and proceed, after the survey's completion, with an interim expiring date, which will be replaced by a full-term certificate, issued by the flag administration. The full-term certification issued by the flag administration has a five-year validity, endorsed only on the third anniversary date with an intermediate examination. The International Ship Security Certificate (ISSC) shall be renewed after five years from its issuance with a renewal examination (RINA, 2022).

7.19 MARITIME LABOUR CERTIFICATE

The Maritime Labour Certificate is a requirement under the provisions of Article V and Title 5 of the Maritime Labour Convention, in 2006. The Convention's scope is to provide protection for the seafarers' rights, generally divided into the following titles (Maritime Labour Convention, 2006):

Title 1: Minimum requirements for seafarers to work on a ship

Title 2: Conditions of employment

Title 3: Accommodation, recreational facilities, food and catering

Title 4: Health protection, medical care, welfare and social security protection

Title 5: Compliance and enforcement

Figure 30: Maritime Labour Convention's titles (Maritime Labour Convention, 2006)

Before certifying the vessel with the Maritime Labour Certificate, the attending surveyor will have to examine thoroughly all the following items:

- Minimum age
- Medical certification
- Qualifications of seafarers
- Seafarers' employment agreements
- Use of any licensed or certified or regulated private recruitment and placement service
- Hours of work or rest
- Manning levels for the ship
- Accommodation
- On-board recreational facilities
- Food and catering
- Health and safety and accident prevention
- On-board medical care
- On-board complaint procedures
- Payment of wages

Figure 31: Examination requirements prior certification (Maritime Labour Convention, 2006)

The surveyor who will attend onboard shall be authorized by a recognized authority and shall examine the vessel under the guidelines set out in Appendix A5-I of the Convention. Once the initial examination of all living conditions of the crew onboard the vessel is complete, the initial certification will be issued, with a six-month validity. Prior to the interim certificate's expiration date, vessel's owners or managers shall request a survey onboard for the issuance of a full-term Maritime Labour Certificate (MLC). The full-term certification has a five-year validity, and shall be endorsed by an intermediate survey, which shall be conducted between the second and third anniversary date (the date of issuance). A renewal survey must be carried out, three months prior to the certificate's expiration date.

CONCLUSIONS

The classification societies have a mandatory role in the maritime community. Apart from constantly improving the sustainability of the vessels and subsequently contribute to the protection of the environment, they also preserve the safety of human life at sea. Nowadays, it is imperative for a merchant vessel to sail with the required certification. The lack of one certificate can lead to major issues, not only for the vessel itself, but also for all the parties involved (owner, charterer, underwriter). It is therefore crucial for the vessel, the personnel ashore and onboard to comply with the classification society's rules and instructions.

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