Amendments to the "RINA Rules for the Classification of Ships"

Effective from 1/1/2023

Reasons of the amendments:

Part A – Classification and Surveys

Chapter/Section/Paragraph amended	Reason
Ch 1, Sec 1, [1.2.1], [1.4.1], [3.8.1], [3.8.2], [3.8.3] Ch 1, Sec 2, [6.14.50] Ch 2, Sec 2, [2.1.9](new) and [2.15] (new) Ch 2, App 5(new) Ch 5, Sec 12, [34]	to introduce **IACS UR Z29** (New, Mar 2022) "Remote Classification Surveys"
Ch 1, Sec 2, [6.7.5], [6.14.54], Tab 3 Ch 5, Sec 1, Tab 1 Ch 5, Sec 12, [1.1.1], [21](title), [35.1.1], [39](new)	to introduce the new additional class notation **NOISE-PORT-IN(X)** for ships satisfying specified levels of noise through noise measurements in port area in board, allowing the shipowner to benefit of port fee reductions depending on the Environmental Ship Index (ESI) score used to reward and incentivize ships having low noise emissions in air; the existing COMF-NOISE-PORT notation for ships satisfying specified levels of noise through noise measurements in port area outboard has consequently be renamed **NOISE-PORT-OUT(X)** (Prop. 167)
Ch 1, Sec 2, [6.14.23], [6.14.37], Tab 3 Ch 3, Sec 9, Title Ch 5, Sec 1, Tab 1 Ch 5, Sec 12, [1.1.1], [27](title), [27.1.1], [27.1.2], [27.2.1], [27.2.2], [27.3.1], [27.3.2]	to change the name of the GAS FUELLED and GAS READY (X1, X2, X3…) additional class notations into: • **LNG FUELLED** or **CNG FUELLED**; and • **LNG READY (X1, X2, X3…)** or **CNG READY (X1, X2, X3…)** since - after the introduction of requirements applicable to ships using other gases as fuel (e.g. Hydrogen, Ammonia, Methanol) – the generic term GAS needed to be better specified (Prop. 173)
Ch 1, Sec 2, [6.14.30], Tab 3 Ch 5, Sec 1, Tab 1 Ch 5, Sec 12, [1.1.1], [19]	to introduce the new **PERSONNEL LIFTING** additional class notation for units provided with a crane or lifting arrangements intended to be used for personnel lifting (Prop. 198)
Ch 1, Sec 2, [6.14.46], Tab 3 Ch 5, Sec 1, Tab 1 Ch 5, Sec 12, [1.1.1], [30.1.1], [41](new)	to introduce the new **DIGITAL SHIP (D)** additional class notation for ships fitted with one or more approved electronic system/digital tool enabling the collection on board of documentary data in place of paper copies; duplicated by a secondary mean or by the possibility to transmit data ashore keeping synchronized the two data storage databases; and capable of sharing stored data with the Society; and to change into **DIGITAL SHIP (ADC)** the name of the existing DIGITAL SHIP additional class notation for ships fitted with an Automatic Data Collection (ADC) system enabling the collection of navigation and machinery data and capable of transferring ashore the data (either as collected or elaborated as necessary (Prop. 205)
Ch 1, Sec 2, [6.14.61](new), Tab 3	to introduce the new **FUEL CELL POWERED SHIP** additional class notation for ships where fuel cells are installed to supply essential or not-essential services, in compliance with the new design and constructional requirements introduced in Pt C, Ch 2, App 3 (Prop.125)
Ch 1, Sec 2, [6.14.62](new), [6.14.63](new), [6.14.64](new), Tab 3	to introduce the following new additional class notations: • **REDUCED WEIGHT OF ANCHOR (RW) AND SUPER REDUCED WEIGHT OF ANCHOR (SRW)** for ships using high holding power anchors or super high holding power anchors, respectively

	• **NOx-Tier III for** ships having all marine diesel engines with power output greater than 130 kW (other than those exempted by Reg. 13 of MARPOL Annex VI) certified for compliance with Para 5.1 of Reg. 13 of MARPOL Annex VI and provided with an approved NOx Technical File and Engine International Air Pollution (EIAPP) certification • **EEDI-Ph3 for** ships whose verified attained Energy Efficiency Design Index (EEDI) value is less than or equal to the required value for EEDI Phase 3 in Reg.24 of MARPOL Annex VI (Prop. 198)
Ch 1, Sec 2, [6.14.65](new), Tab 3 Ch 5, Sec 1, Tab 1, Ch 5, Sec 12, [1.1.1], [38](new)	to introduce the new additional class notation **CARGO PIPING PROTECTED (CPP)** for ships having all cargo piping and valve control piping located above the double bottom and complying with specific pollution prevention measures introduced in Pt F, Ch 13, Sec 41 (Prop. 198)
Ch 1, Sec 2, [6.14.66](new), Tab 3 Ch 5, Sec 1, Tab 1, Ch 5, Sec 12, [1.1.1], [40](new)	to introduce new additional class notation **COATING PERFORMANCE STANDARD IN CARGO OIL TANKS (CPS-COT)** for crude oil tankers surveyed during construction by RINA, whose cargo oil tanks have been provided with protective coatings complying with the requirements introduced in in Pt F, Ch 13, Sec 43, aligned to those in IMO Performance Standard for Protective Coatings for Cargo Oil Tanks of Crude Oil Tankers in Res. MSC.288(87) (Prop. 198)
Ch 1, Sec 2, [6.14.67](new), Tab 3 Ch 5, Sec 1, Tab 1 Ch 5, Sec 12, [1.1.1], [42](New)	to introduce the new **FUEL SAMPLING** additional class notation for ships having the fuel oil supply system provided with sampling points complying not only with the mandatory requirements for all ships (in Pt C, Ch 1, Sec 10, [11.10.5]), but also with additional location requirements derived from IACS Rec.151 “Recommendation for fuel oil treatment systems” (Prop. 187)
Ch 2, Sec 2, [2.2.2] Ch 4, Sec 5, Tab 4	to introduce **IACS UR Z10.3** (Rev.20 - May 2022) “Hull Surveys of Chemical Tankers”
Ch 2, Sec 2, [2.2.2] Ch 4, Sec 4, Tab 3	to introduce **IACS UR Z10.4** (Rev.17 - May 2022) “Hull Surveys of Double Hull Oil Tankers”
Ch 3, Sec 3, [2.2.1], [3.1.1], Ch 4, Sec 7, [2.4](new)	to introduce **IACS UR Z1** (Rev.9 - July 2022) “Annual and intermediate classification survey coverage of IMO Resolution A.1156(32)”

Part B - Hull and Stability

Chapter/Section/Paragraph amended	Reason
Ch 5, Sec 5, [1.2.1], [1.2.2](New) Ch 8, Sec 1, [4.2](New), Tab 6, Tab 7(deleted)	to improve the requirements on exposed deck loads by: • clarifying the application of still water and wave pressures on exposed decks when other loads are present contemporarily; and • using the same coefficient for pressure on exposed decks irrespective of the ship length (Prop. 186)
Ch 9, Sec 7, [3.3.3] and [3.3.4] renumbered as [3.4.1] and [3.4.2]	to align the requirements for structural assessment of hatch covers and comings to those in IACS UR S21A "Requirements concerning strength of ships" by correcting an editorial error (i.e. moving sub-paragraphs [3.3.3] and [3.3.4] under paragraph [3.4] "Container Loads")
Ch 10, Sec 4, [3.7.6]	to correct a misprint in formulae for forces in the securing devices of windlasses due to green sea loads

Part C - Machinery, Systems and Fire Protection

Chapter/Section/Paragraph amended	Reason
Ch 1, Sec 2, [5.1.1]	to introduce **IACS UR M61** (Rev 1 – Feb 2022) “Starting Arrangements of Internal Combustion Engines”

Ch 1, Sec 3, [3.3.12]	to improve the requirements for calculating the thickness of opening covers in cylindrical, spherical and conical shells with circular cross-sections subject to internal pressure, clarifying how to perform calculations for concave covers and covers located on the dished heads (Prop. 201)
Ch 1, Sec 5, Tab 1, [2.5.7], Tab 2	to introduce **IACS UR M60** (Rev 1 – Nov 2021) "Control and Safety of Gas Turbines for Marine Propulsion Use"
Ch 1, Sec 14, [1.1.5](New)	to introduce **IACS UR M73** (Rev.1 Mar 2022) "Turbochargers"
Ch 1, App 7, Title	to clarify that App 7 apply to LNG or CNG fuelled ships, since - after the introduction of other appendices applicable to ships using other gases as fuel (e.g. Hydrogen, Ammonia, Methanol) - the generic term "gas" in the title of App 7 needed to be better specified (Prop. 173)
Ch 2, Sec 1, Tab 1 Ch 2, Sec 7, Title, [4](New) Ch 2, App 3(New)	to introduce new requirements applicable to the arrangement, installation, control, monitoring and safety systems of ships using fuel cell power installations to which the new **FUEL CELL POWERED SHIP** additional class notation is assigned (Prop. 125)
Ch 2, Sec 3, [3.7.3], d)	to introduce an editorial correction for a better understanding of the requirements for the emergency source of electrical power derived from the SOLAS Convention (Prop. 189)
Ch 2, Sec 7, [3.1.1], [3.4.1]	to extend the application of requirements for uninterruptible power system (UPS) units as alternative and/or transitional power also to non-SOLAS ships (Prop. 189)

Part D – Materials and Welding

Chapter/Section/Paragraph amended	Reason
Ch 1, Sec 2, [1.2.1], [2.1.10], [2.2.4], [5.1.1], [7.1.1], [7.2.1], [7.3.1], [7.4.1], [7.5.1]	to introduce **IACS UR W2** (Rev 3 – Sep 2021) "Test specimens and mechanical testing procedures for materials"
Ch 2, Sec 1, [2.3.3]	to introduce **IACS UR W13** (Rev 7 – Sep 2021) "Thickness tolerances of steel plates and wide flats"
Ch 2, Sec 1, [9.9.1]	to introduce **IACS UR W14** (Rev 3 – Sep 2021) "Steel plates and wide flats with specified minimum through thickness properties ("Z" quality)"
Ch 3, Sec 2, [2.2.1], [2.5.2], [2.5.3]	to introduce **IACS UR W25** (Rev 6 – Sep 2021) "Aluminium Alloys for Hull Construction and Marine Structure"
Ch 4, Sec 1, [2.9.2], [2.9.7]	to introduce **IACS UR W18** (Rev 6 – Sep 2021) "Anchor chain cables and accessories including chafing chain for emergency towing arrangements"
Ch 5, Sec 2, [4.5.2], [8.4.1]	to introduce **IACS UR W17** (Rev 6 – Sep 2021) "Approval of consumables for welding normal and higher strength hull structural steels"
Ch 5, Sec 2, [12.1.1] Ch 5, Sec 4, [1.2.1]	to introduce **IACS UR W26** (Rev 2 – Sep 2021) "Requirements for Welding Consumables for Aluminium Alloys"

Part E – Service Notations

Chapter/Section/Paragraph amended	Reason
Ch 9, Sec 5, [2.1.1], [2.6.1], [2.8.1]	to clarify the testing requirements for the cargo pipes of gas carriers, having both single and double wall arrangements, by: • assigning them a Class of piping systems (as defined in Pt C, Ch 1, Sec 10, Tab 3) and referring to the testing requirements in Pt C, Ch 1, Sec 10, Table 36; and • introducing additional requirements to fully cover those in the ICG Code. (Prop. 182)
Ch 11, Sec 5, [2.2.3], c)	to introduce an editorial correction for a better understanding of the requirements for the emergency source of electrical power of passenger ships derived from the SOLAS Convention (Prop. 189)

Part F – Additional Class Notations

Chapter/Section/Paragraph amended	Reason
Ch 6, Sec 4, [1.1.1], [1.2.2](new), [1.2.3](new), [1.2.2](renumbered [1.2.4]), [2.1.1], [2.1.2], [3.1.1], [4.1.1], [4.1.3], [4.2.1], [4.2.2](moved to [4.2.1]), [4.2.3](moved to [4.2.1]), [4.2.2](new), [4.3.1], [4.4.4], [4.4.5], [4.5](new), [5.2.1], [5.2.2], [5.3.1], [5.3.2](moved to [5.3.1]), [5.4.1](renumbered [5.3.2]), [5.4.2](moved to [5.3.2]), [5.4.3](moved to [5.3.2]), [5.4](new), [5.4.4](renumbered [6]) Ch 13, Sec 36, [1.1.1], [2.1.1], [3.1.1], [5.1.2], Tab 1	to introduce the requirements for the assignment of the new additional class notation **NOISE-PORT-IN(X)** and change the name of the existing COMF-NOISE-PORT notation into **NOISE-PORT-OUT(X)** (Prop. 167)
Ch 13, Sec 6, [11.5.13], o)	to modify the functional requirement for **DP PLUS-PRD** additional class notation (i.e. dynamic positioning predictive notation for units allowing operative conditions with reduced fuel consumptions due to enhanced automation capabilities) relevant to the standby generator's capability to start and supply power within a certain time, based on the experience gained its application (Prop. 208)
Ch 13, Sec 24, Title, [1.1.1], [2.1.1], Tab 1, [3.1.1]	to change the name of the GAS READY (X1, X2, X3…) additional class into **LNG READY (X1, X2, X3…)** or **CNG READY (X1, X2, X3…)** since - after the introduction of requirements applicable to ships using other gases as fuel (e.g. Hydrogen, Ammonia, Methanol) – the generic term GAS needed to be better specified (Prop. 173)
Ch 13, Sec 30, [1.1.1], [3.1.1], [4.1.2], [4.6.1] Ch 13, Sec 44(New)	to change the name of the existing DIGITAL SHIP additional class notation into **DIGITAL SHIP (ADC)**; and to introduce the requirements for the assignment of the new **DIGITAL SHIP (D)** additional class notation (Prop. 205)
Ch 13, Sec 34, [1.1.1], [1.1.2](deleted), [1.2.1], [2.3.1], [2.4.1]	to introduce **IACS UR Z29** (New, Mar 2022) "Remote Classification Surveys"
Ch 13, Sec 41(new)	to introduce the requirements for the assignment of the new **CARGO PIPING PROTECTED (CPP)** additional class notation (Prop. 198)
Ch 13, Sec 42(new)	to introduce the requirements for the assignment of the new **PERSONNEL LIFTING** additional class notation (Prop. 198)
Ch 13, Sec 43(new) and App 4	to introduce the requirements for the assignment of the new **COATING PERFORMANCE STANDARD IN CARGO OIL TANKS (CPS-COT)** additional class notation (Prop. 198)
Ch 13, Sec 45(New)	to introduce the requirements for the assignment of the new **FUEL SAMPLING** additional class notation (Prop. 187)

SECTION 1 GENERAL PRINCIPLES OF CLASSIFICATION

1 Principles of classification

1.1 Purpose of the Rules

1.1.1 The Rules published by the Society give the requirements for the assignment and the maintenance of class for seagoing ships.

Class assigned to a ship reflects the discretionary opinion of the Society that the ship, for declared conditions of use and within the relevant time frame, complies with the Rules applicable at the time the service is rendered.

Note 1: The general conditions of classification are laid down in the "General Conditions" placed at the biginning of this Part.

1.1.2 *(1/1/2008)*

The application criteria of the different parts of the present Rules are the following with the exceptions indicated in [1.1.3] and [1.1.4]:

- Part A - Classification and Surveys applies to all ships.
- Part B - Hull and Stability, Part C - Machinery, Systems and Fire Protection, Part D - Materials and Welding and Part E - Service Notations apply to seagoing ships whose hull is of welded steel construction. Where necessary, the extent of application is more precisely defined in each chapter of these parts of the Rules.
- Part F - Additional Class Notations applies, at the request of the Interested Party, to all ships.

The classification of ships other than those dealt with in the above-mentioned Parts B, C, D and E is covered by specific Rules published by the Society.

Note 1: As from 1 January 2007, the statutory requirements of the SOLAS Convention and/or national safety regulations, as applicable, regarding fire protection, detection and extinction (hereinafter referred to as "fire protection statutory requirements") are no longer mandatory for the purpose of classification, except where the Society carries out surveys relevant to fire protection statutory requirements on behalf of the flag Administration. In such cases, fire protection statutory requirements are considered a matter of class and therefore compliance with these requirements is also verified by the Society for classification purposes at class surveys.

In general, only IACS Unified Requirements in force related to fire protection, detection and extinction have been retained as Rule requirements within the scope of classification. Thus, the survey requirements for class surveys (annual, intermediate, class renewal surveys and others) no longer include those related to fire protection statutory requirements.

The above is applicable to all ships (new buildings and ships in service) and therefore the scope of surveys as stipulated in the present Part A has also been reduced accordingly for all ships.

1.1.3 *(1/1/2021)*

For the hull structures of ships contracted for construction on or after 1 April 2006, the Common Structural Rules are to be applied in the following cases:

- single side skin and double side skin bulk carriers with unrestricted navigation, having length L of 90 m or greater, contracted for construction on or after 1 April 2006 but before 1 July 2015, (as defined in Chapter 1, Sec 1, [1.1.2] of the "Common Structural Rules for Bulk Carriers"),
- double hull oil tankers of 150 m length or greater contracted for construction on or after 1 April 2006 but before 1 July 2015 (as defined in Section 1 of the "Common Structural Rules for Double Hull Oil Tankers"),
- single side skin and double side skin bulk carriers with unrestricted navigation, having length L of 90 m or greater, contracted for construction on or after 1 July 2015, (as defined in Part 1 Chapter 1, Sec 1, [1.2] of the "Common Structural Rules for Bulk Carriers and Oil Tankers"),
- double hull oil tankers of 150 m length or greater, with unrestricted navigation, contracted for construction on or after 1 July 2015, (as defined in Part 1 Chapter 1, Sec 1, [1.3] of the "Common Structural Rules for Bulk Carriers and Oil Tankers").

1.1.4 *(1/1/2008)*

Special consideration may be given in application of Rule requirements relevant to periodical surveys of:

- the hull,
- machinery, including boilers,
- the outside of the ship's bottom and related items, and
- tailshafts,

for commercial ships owned or chartered by Governments, which are used in support of military operations or service. The above special consideration cannot be given in application of hull survey requirements regarding ESP ships.

1.2 General definitions

1.2.1 *(1/1/2023)*

The following general definitions are used in these Rules:

- Society means RINA Services S.p.A. and/or all the companies in the RINA Group which provide the Services
- Rules means these Rules for the Classification of Ships and documents issued by the Society serving the same purpose
- Common Structural Rules means the "Common Structural Rules for Bulk Carriers", the "Common Structural Rules for Double Hull Oil Tankers" and the "Common Structural Rules for Bulk Carriers and Oil Tankers" adopted by IACS
- Surveyor means technical staff acting on behalf of the Society to perform tasks in relation to classification and survey duties
- Survey means an intervention by the Surveyor for assignment or maintenance of class as defined in Chapter 2, or interventions by the Surveyor within the limits of the tasks delegated by the Administrations

- Remote Survey is a process of verifying that a ship and its equipment are in compliance with the Rules where the verification is undertaken, or partially undertaken, ~~means a survey carried out by the Society~~ without ~~physical~~ attendance of the Surveyor on board~~, based upon appropriate digital evidence (videos, pictures, documents) taken in livestreaming and/or offline and gathered to demonstrate continuing compliance with the Rules~~.

  Note 1: Remote classification activities not requiring a survey, such as some administrative tasks, are not to be considered as remote surveys.
- Administration means the Government of the State whose flag the ship is entitled to fly or the State under whose authority the ship is operating in the specific case
- Interested Party means a party, other than the Society, having responsibility for the classification of the ship, such as the Owner of the ship and his representatives, or the Shipbuilder, or the Engine Builder, or the Supplier of parts to be tested
- QSCS Classification Society means a Classification Society which is subject to verification of compliance with the IACS Quality System Certification Scheme (QSCS)
- Owner means the Registered Owner or the Disponent Owner or the Manager or any other party having the responsibility to keep the ship seaworthy, having particular regard to the provisions relating to the maintenance of class laid down in Chapter 2
- Approval means the examination and acceptance by the Society of documents, procedures or other items related to classification, verifying solely their compliance with the relevant Rules requirements, or other references where requested
- Type approval means an approval process for verifying compliance with the Rules of a product, a group of products or a system, and considered by the Society as representative of continuous production
- Essential service is intended to mean a service necessary for a ship to proceed at sea, be steered or manoeuvred, or undertake activities connected with its operation, and for the safety of life, as far as class is concerned.

1.3 Meaning of classification, scope and limits

1.3.1 The classification consists of:

- the development of Rules, guides and other documents relevant to the ship, structure, material, equipment, machinery and any other item covered by such documents
- the examination of plans and calculations and the surveys, checks and tests intended to ensure that the ship meets the Rules (refer to Ch 2, Sec 1)
- the assignment of class (see Ch 2, Sec 1) and issue of a Certificate of Classification, where the above Rules are met
- the periodical, occasional and class renewal surveys performed to verify that the ship in service meets the conditions for maintenance of class (see Ch 2, Sec 2).

1.3.2 The Rules, surveys performed, reports, certificates and other documents issued by the Society, are in no way intended to replace or alleviate the duties and responsibilities of other parties such as Administrations, Designers, Shipbuilders, Manufacturers, Repairers, Suppliers, Contractors or Sub-contractors, actual or prospective Owners or Operators, Charterers, Brokers, Cargo-owners and Underwriters. The Society cannot therefore assume the obligations arising from these functions, even when the Society is consulted to answer inquiries concerning matters not covered by its Rules, or other documents.

The activities of such parties which fall outside the scope of the classification as set out in the Rules, such as design, engineering, manufacturing, operating alternatives, choice of type and power of machinery and equipment, number and qualification of crew or operating personnel, lines of the ship, trim, hull vibrations, spare parts including their number, location and fastening arrangements, life-saving appliances, and maintenance equipment, remain therefore the responsibility of those parties, even if these matters may be given consideration for classification according to the type of ship or additional class notation assigned.

The classification-related services and documents performed and issued by the Society do not relieve the parties concerned of their responsibilities or other contractual obligations expressed or implied or of any liability whatsoever, nor do they create any right or claim in relation to the Society with regard to such responsibilities, obligations and liabilities. In particular, the Society does not declare the acceptance or commissioning of a ship or any part of it, this being the exclusive responsibility of the Owner.

1.3.3 Unless otherwise specified, the Rules do not deal with structures, pressure vessels, machinery and equipment which are not permanently installed and used solely for operational activities such as dredging or heavy load lifting, workshops or welding equipment, except for their effect on the classification-related matters, as declared by the Interested Party, such as fire protection and ship's general strength.

During periods of construction, modification or repair, the unit is solely under the responsibility of the builder or the repair yard. As an example, the builder or repair yard is to ensure that the construction, modification or repair activities are compatible with the design strength of the ship and that no permanent deformations are sustained.

Note 1: Refer to [3.3] as regards the Owner's responsibility for maintenance and operation of the ship in relation to the maintenance of class.

1.4 Request for services

1.4.1 *(1/1/2023)*

Requests for interventions by the Society, such as suveys during construction, surveys of ships in service, tests, etc., are in principle to be submitted in writing and signed by the Interested Party. Such request implies that the applicant will abide by all the relevant requirements of the Rules, including its "General Conditions".

In case the Interested Party requests a survey, test, etc. to be remotely carried out, the Society reserves to accept the request in its absolute discretion.

A remote survey may be carried out if the ship complies with the requirements in Ch 2, Sec 2, [2.1.9] and Ch 2, App 5.

In case the Society accepts the remote survey request, the Interested Party is ~~responsible~~ to ensure compliance with the require-

ments in Ch 2, App 5, that imply the Owner/Owner's representative responsibility. ~~the following:~~

- ~~an effective Wi-Fi internet connection is available on board~~;
- ~~an App suitable for livestreaming is installed on a ship's mobile electronic device;~~
- ~~there are no local port restrictions for using the above mentioned device;~~
- ~~the STCW certificate of the ship's master is made available to the Society;~~
- ~~the ship's master and the crew comply with the instructions given by the Society in the Remote Survey Protocol.~~

The Society reserves the right to refuse or withdraw the class of any ship for which any applicable requirement of the Rules is not complied with.

1.5 Register of ships

1.5.1 A Register of Ships is published periodically by the Society. This publication, which is updated by the Society, contains the names of ships which have received the Certificate of Classification, as well as particulars of the class assigned and information concerning each ship.

2 Rules

2.1 Equivalence

2.1.1 The Society may consider the acceptance of alternatives to these Rules, provided that they are deemed to be equivalent to the Rules to the satisfaction of the Society.

2.2 Effective date

2.2.1

The effective date of entry into force of any amendments to the Rules is indicated on the inside front page of each Part of the Rules.

2.2.2 *(1/7/2007)*

In principle, the applicable Rules for assignment of class to a new ship are those in force at the date when the contract for construction between the Owner and the shipbuilder is signed (see Note 1).

Note 1:

a) The date of "contract for construction" of a ship is the date on which the contract to build the ship is signed between the prospective Owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the ships included are to be declared to the Society by the party applying for the assignment of class to a new building.

b) The date of "contract for construction" of a series of ships, including specified optional ships for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective Owner and the shipbuilder. For the purpose of this issue, ships built under a single contract for construction are considered a "series of ships" if they are built to the same approved plans for classification purposes. However, ships within a series may have design alterations from the original design provided:

1) such alterations do not affect matters related to classification, or

2) if the alterations are subject to classification requirements, either these alterations comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective Owner and the shipbuilder or, in the absence of the alteration contract, they comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.

The optional ships will be considered part of the same series of sister ships, if the option is exercised not later than one year after the contract to build the series was signed.

c) If a contract for construction is later amended to include additional ships or additional options, the date of "contract for construction" for such ships is the date on which the amendment to the contract is signed between the prospective Owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which a) and b) above apply.

d) If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified ship, or ships, is the date on which the revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

2.2.3 Special consideration may be given to applying new or modified rule requirements which entered into force subsequent to the date of the contract, at the discretion of the Society and in the following cases:

- when a justified written request is received from the party applying for classification
- when the keel is not yet laid and more than one year has elapsed since the contract was signed
- where it is intended to use existing previously approved plans for a new contract.

2.2.4 The above procedures for application of the Rules are, in principle, also applicable to existing ships in the case of major conversions and, in the case of alterations, to the altered parts of the ship.

2.2.5 The rule requirements related to assignment, maintenance and withdrawal of the class of ships already in operation, are applicable from the date of their entry into force.

2.2.6 *(1/7/2020)*

In principle, the applicable Rules for the certification of a new equipment to be installed on board are those in force at the date of the Manufacturer request for certification.

Special consideration may be given in applying other requirements, e.g. those in force when the contract for ship construction was signed, at the discretion of the Society.

2.3 Novel features

2.3.1 The Society may consider the classification of ships based on or applying novel design principles or features, to which the Rules are not directly applicable, on the basis of experiments, calculations or other supporting information provided to the Society. The specific limitations may then be indicated on the Certificate of Classification.

3.8 Evidences for remote survey

3.8.1 *(1/1/2023)*

In case of remote survey carried out on the basis of digital or documentary evidences (videos, pictures, documents) taken in live-streaming and/or offline mode the Interested Party undertakes that they are relevant to the ship and to the item/equipment under survey, taken by the responsible personnel/crew on a specific date/time to be declared to RINA and original, i.e. they have not been manipulated or altered.

3.8.2 *(1/1/2023)*

Both in the case of live-streaming and offline remote survey all digital or documentary evidences provided during the remote survey shall be complete to the satisfaction of RINA's surveyor. At any time before, during and/or at completion of the remote survey and in its absolute discretion RINA reserves to:

a) ask for further documentary evidence; and/or

b) request a live-streaming remote survey in case an offline remote survey is requested; and/or

c) request a traditional survey with the physical presence of its surveyor(s) on board the ship in case the remote survey does not provide the same level of assurance of attendance on boarda live-streaming or offline remote survey is requested.

3.8.3 *(1/1/2023)*

At the end of the remote survey in live-streaming the ship's master is to record in the ship's logbook the details of the live-streaming remote survey carried out by the Society, including the date and time of survey, the port of the survey, the scope of the survey, the identity and rank of the crew members using the devices to take digital evidences.

In case the remote survey cannot be carried out in livestreaming for specific survey items due to a lack of an effective internet connection, digital evidences taken offline can be provided to the Society upon agreement of the attending Surveyor. These evidences shall be provided as and when agreed with the Surveyor and will be reviewed by the Surveyor during the live-streaming remote survey. This evidence is to be reviewed by the attending surveyor before completion of the remote survey. At the time the digital evidences taken offline are submitted to the Society, the master is to record this action in the ship's logbook: such recording must include date and time on which the electronic files were taken, port or place, scope of the survey, item or equipment subject of the survey, identity and rank of the crew members using the devices to take the offline digital evidences provided to the Society.

Evidence of the above-mentioned recordings in the ship's logbook are to be provided to the Surveyor.

SECTION 2 CLASSIFICATION NOTATIONS

1 General

1.1 Purpose of the classification notations

1.1.1 The classification notations give the scope according to which the class of the ship has been based and refer to the specific rule requirements which are to be complied with for their assignment. In particular, the classification notations are assigned according to the type, service and navigation of the ship and other criteria which have been provided by the Interested Party, when applying for classification.

The Society may change the classification notations at any time, when the information available shows that the requested or already assigned notations are not suitable for the intended service, navigation and any other criteria taken into account for classification.

Note 1: Reference should be made to Sec 1, [1.3] on the limits of classification and its meaning.

1.1.2 The classification notations assigned to a ship are indicated on the Certificate of Classification, as well as in the Register of Ships published by the Society.

1.1.3 *(1/7/2008)*

Ships and units, other than those covered in Parts B, C, D, E and F, are to comply with specific Rules published by the Society, which also stipulate the relevant classification notations.

1.1.4 The classification notations applicable to existing ships conform to the Rules of the Society in force at the date of assignment of class, as indicated in Ch 2, Sec 1. However, the classification notations of existing ships may be updated according to the current Rules, as far as applicable.

1.2 Types of notations assigned

1.2.1 The types of classification notations assigned to a ship are the following:

a) main class symbol
b) construction marks
c) service notations with additional service features, as applicable
d) navigation notations
e) operating area notations (optional)
f) additional class notations (optional)

The different classification notations and their conditions of assignment are listed in [2] to [6] below, according to their types.

1.2.2 As an example, the classification notations assigned to a ship may be as follows (the kind of notation shown in brackets does not form part of the classification notation indicated in the Register of Ships and on the Certificate of Classification):

C ✠ HULL ✠ MACH

(main class symbol, construction marks)

oil tanker-chemical tanker-ESP-Flash point > 60°C

(service notation and additional service features)

Unrestricted navigation

(navigation notation)

✠SYS - NEQ

(additional class notation).

2 Main class symbol

2.1 Main class symbol

2.1.1 The main class symbol expresses the degree of compliance of the ship with the rule requirements as regards its construction and maintenance. There is one main class symbol, which is compulsory for every classed ship.

2.1.2 *(1/1/2009)*

The main class symbol C is assigned to ships built in accordance with the requirements of the Rules or other rules recognised as equivalent, and maintained in a condition considered satisfactory by the Society. The period of class (or interval between class renewal surveys) assigned to a ship is maximum 5 years; see Ch 2, Sec 2, [4].

Except for special cases, class is assigned to a ship only when the hull, propulsion and auxiliary machinery installations, and equipment providing essential services have all been reviewed in relation to the requirements of the Rules.

Note 1: The symbol **C** with the 5 year class period is to be understood as being the highest class granted by the Society.

Note 2: The symbol **C** may be followed by the additional construction feature **light ship** in case of ships or other units having restricted navigation notations and generally having length not greater than 50 m as well as speed greater than 15 knots, whose hull scantlings and outfitting comply with the applicable requirements of Chapters 3 and 6 of the "Rules for the Classification of High Speed Craft", issued separately by the Society.

3 Construction marks

3.1 General

3.1.1 The construction mark identifies the procedure under which the ship and its main equipment or arrangements have been surveyed for initial assignment of

5 Navigation and operating area notations

5.1 Navigation notations

5.1.1 Every classed ship is to be assigned one navigation notation as listed in [5.2].

5.1.2 The assignment of a navigation notation, including the reduction of scantlings or specific arrangements for restricted navigation notations, is subject to compliance with the requirements laid down in Part B, Part C, Part D and Part E of the Rules.

5.1.3 The assignment of a navigation notation does not absolve the Interested Party from compliance with any international and national regulations established by the Administrations for a ship operating in national waters, or a specific area, or a navigation zone. Neither does it waive the requirements in Sec 1, [3.3.1].

5.2 List of navigation notations

5.2.1 The navigation notation **unrestricted navigation** is assigned to a ship intended to operate in any area and any period of the year.

5.2.2 The navigation notation **summer zone** is assigned to ships intended to operate only within the geographical limits as defined in ILLC 1966 for the Summer zones.

5.2.3 The navigation notation **tropical zone** is assigned to ships intended to operate only within the geographical limits as defined in ILLC 1966 for the Tropical zones.

5.2.4 The navigation notation **coastal area** is assigned to ships intended to operate only within 20 nautical miles from the shore and with a maximum sailing time of six hours from a port of refuge or safe sheltered anchorage.

5.2.5 The navigation notation **sheltered area** is assigned to ships intended to operate in sheltered waters , i.e. harbours, estuaries, roadsteads, bays, lagoons and generally calm stretches of water and when the wind force does not exceed 6 Beaufort scale.

5.2.6 *(1/7/2009)*

The navigation notations defined in these items [5.2.1] to [5.2.5] are those considered as "normal". Where particular cases of navigation are to be assigned which are not included among those so defined, the navigation notation **special** is assigned, followed by specified restrictions (such as the designation of the geographical area, distance from the shore and/or the most unfavourable sea conditions considered).

5.2.7 *(1/7/2009)*

The Society may assign navigation notations provided by the regulations of the flag Administration, which may be different from those defined in [5.2.1] to [5.2.6].

5.3 Operating area notations

5.3.1 The operating area notation expresses the specified area where some service units are likely to operate at sea within specific restrictions which are different from normal navigation conditions.

The operating area notation is, in principle, solely granted to working units, such as dredgers and crane pontoons.

This operating area notation is indicated after the navigation notation.

Example: **unrestricted navigation - "operating area notation"**

5.3.2 The following operating area notations may be assigned:

a) notation **specified operating area**, where the specific operating conditions which have been considered by the Society are described in an annex to the Certificate of Classification (i.e. distance from shore or from port of refuge, weather or sea conditions)

b) notation **operation service within 'x' miles from shore**, where the operating service is limited to a certain distance from the shore.

6 Additional class notations

6.1 General

6.1.1 An additional class notation expresses the classification of additional equipment or specific arrangement, which has been requested by the Interested Party.

6.1.2 The assignment of such an additional class notation is subject to the compliance with additional rule requirements, which are detailed in Part F of the Rules.

6.1.3 Some additional class notations, due to the importance of relevant equipment or arrangements, are assigned a construction mark, according to the principles given in [3.1.2]. This is indicated in the definition of the relevant additional class notations.

6.1.4 The different additional class notations which may be assigned to a ship are listed in [6.2] to [6.14], according to the category to which they belong. These additional class notations are also listed in alphabetical order in Tab 3.

6.2 System of Trace and Analysis of Records (STAR)

6.2.1 General *(1/7/2008)*

STAR is a System of Trace and Analysis of Records integrating rational analysis with data and records from ship-in-service concerning planned inspection and ship maintenance.

The requirements for the assignment of these notations are given in Part F, Chapter 1.

and manoeuvring operation of the ship by two persons in cooperation.

The additional class notation **SYS-NEQ-1** is assigned when, in addition to the above, the installation is so arranged that the navigation and manoeuvring of the ship can be operated under normal conditions by one person, for periodical one man watch. This notation includes specific requirements for prevention of accidents caused by the operator's unfitness.

6.5.3 Integrated bridge system (SYS-IBS)

The additional class notation **SYS-IBS** is assigned to ships which are fitted with an integrated bridge system which allows simplified and centralised bridge operation of all main functions of navigation manoeuvring and communication, as well as monitoring from bridge of other functions related to specific cargoes and pollution ; for passenger ships, heating, ventilation and air conditioning are also included in the monitored functions.

6.5.4 Communication system (SYS-COM) *(1/7/2009)*

The additional class notation **SYS-COM** is assigned to ships which are fitted with a local area network including the alarm, monitoring and control systems and computers used for management operations and external communication devices for reporting ashore navigation, maintenance and operational information.

6.6 Monitoring equipment (MON)

6.6.1 General

The notations dealt with under this heading are relevant to hull and tailshaft monitoring equipment installed on board ships.

The requirements for the assignment of these notations are given in Part F, Chapter 5.

6.6.2 Hull stress monitoring (MON-HULL)

The additional class notation **MON-HULL** is assigned to ships which are fitted with equipment continuously monitoring ship's dynamic loads through measurements of motions in waves and stresses/deformations in the hull structure.

6.6.3 Tailshaft monitoring system (MON-SHAFT)

The additional class notation **MON-SHAFT** is assigned to ships which are fitted with a temperature monitoring system for the tailshaft sterntube bearings. The assignment of this notation allows the ship to be granted a reduced scope for complete tailshaft surveys, see Ch 2, Sec 2, [8.3.1].

6.7 Comfort on board ships and in port area (COMF)

6.7.1 General *(1/1/2020)*

The notations dealt with under this heading are relevant to the assessment of comfort on board ships and in port area with regard to the level of noise, vibration and/or air temperature/humidity.

The parameters which are taken into consideration for the evaluation of the comfort such as the level of noise, the level of vibration and the air temperature and/or humidity will be indicated in the Certificate of Classification.

These parameters are only verified once for all when the ship is classed.

The requirements for the assignment of these notations are given in Part F, Chapter 6.

6.7.2 Comfort with regard to noise on board ships (COMF-NOISE) *(1/7/2020)*

The additional class notation **COMF-NOISE** is assigned to ships satisfying levels of noise defined in Pt F, Ch 6, Sec 1. The assessment of noise levels is only carried out through design review and sea trials.

The notation is completed by a letter **A**, **B** or **C** which represents the merit level achieved for the assignment of the notation, the merit **A** corresponding to the lowest level of acceptable noise. The notation **COMF-NOISE** is only assigned if at least the merit level **C** is reached.

When the merit levels achieved for the passenger spaces (if any) and the crew spaces are different, the notation is completed by the suffix:

- **PAX**, for passenger spaces, and
- **CREW**, for crew spaces.

For crew spaces, the following comfort noise notations are equivalent to the noise level limits stated in IMO Resolution MSC.337(91) "Adoption of the code on noise levels on board ships", as follows:

- for ships in continuous service rate (CSR) condition (defined in Pt F, Ch 6, Sec 1, [2.3]) with gross tonnage equal to or greater than 10,000 GT: **COMF-NOISE CREW A**
- for ships in continuous service rate (CSR) condition (defined in Pt F, Ch 6, Sec 1, [2.3]) with gross tonnage from 1,600 GT up to 10,000 GT: **COMF-NOISE CREW B**.

6.7.3 Comfort with regard to vibration on board ships (COMF-VIB) *(1/1/2020)*

The additional class notation **COMF-VIB** is assigned to ships satisfying levels of vibration defined in Pt F, Ch 6, Sec 2. The assessment of vibration levels is only carried out through design review and sea trials.

The notation is completed by a letter **A**, **B** or **C**, which represents the merit level achieved for the assignment of the notation, merit **A** corresponding to the lowest level of vibration. The notation **COMF-VIB** is only assigned if at least merit level **C** is reached.

When the merit levels achieved for the passenger spaces (if any) and the crew spaces are different, the notation is completed by the suffix:

- **PAX**, for passenger spaces, and
- **CREW**, for crew spaces.

6.7.4 Comfort with regard to air temperature/humidity on board ships (COMF-AIR) *(1/1/2020)*

The additional class notation **COMF-AIR** is assigned to ships fitted with a combined heating-ventilation-air conditioning system (HVAC) satisfying levels of air temperature and humidity defined in Pt F, Ch 6, Sec 3. The

assessment of air temperature/humidity levels is only carried out through design review and sea trials in Winter and Summer conditions.

The notation may be completed by one of the letters **W** or **S** when the HVAC system has been satisfactorily tested only in Winter or in Summer conditions respectively.

6.7.5 ~~Comfort with regard to n~~Noise emissions in port area outboard (NOISE-PORT-OUT(X)) and inboard (NOISE-PORT-IN(X))~~(COMF-NOISE-PORT)~~ *(1/1/2023)*

The additional class notations ~~COMF-~~**NOISE-PORT-OUT(X)** and **NOISE-PORT-IN(X)** ~~is~~are assigned to ships satisfying levels of noise in port area defined in Pt F, Ch 6, Sec 4. The assessment of noise levels is only carried out through noise measurements in port area either outboard (for **NOISE-PORT-OUT(X)**) or in board (for **NOISE-PORT-IN(X)**).

The notation is completed by a number (1-100) which represents the merit level achieved for the assignment of the notation, the merit 100 corresponding to the lowest level of noise.

The notations ~~COMF-~~**NOISE-PORT-OUT(X)** and **NOISE-PORT-IN(X)** ~~is~~are only assigned if at least merit level 1 is reached.

6.8 Pollution prevention

6.8.1 General

The notations dealt with under this heading are assigned to ships fitted with equipment and arrangements enabling them to reduce the pollution of the sea and/or air caused by release of solid waste and liquid and/or gaseous effluents.

The requirements for the assignment of these notations are given in Part F, Chapter 7.

6.8.2 Sea pollution prevention (CLEAN-SEA) *(1/7/2006)*

The additional class notation **CLEAN-SEA** is assigned to ships provided with construction and procedural means to prevent pollution of the sea.

This is achieved by compliance with the applicable requirements of Annex I, Annex II, Annex III, Annex IV and Annex V of MARPOL Convention, relevant to ship's liquid and solid releases, as well as additional requirements related to prevention of sea pollution as follows:

- prevention of accidental pollution by means of location of fuel and lube oil tanks above the double bottom and away from ship sides
- prevention of operational pollution by means of bilge water separation and filtering, holding tanks for treated sewage and grey water
- prevention of transfer of harmful organisms and pathogens in the ballast water
- prevention of pollution by tributyltin by means of TBT free antifouling paints
- prevention of pollution by solid garbage (resulting from the compacting device and incinerators) by means of proper storage of such waste
- ship recycling.

6.8.3 Air pollution prevention (CLEAN-AIR) *(1/7/2009)*

The additional class notation **CLEAN-AIR** is assigned to ships provided with construction and procedural means to prevent pollution of the air. This is achieved by compliance with the applicable requirements of Annex VI of MARPOL Convention, as well as additional requirements related to low emissions to the air as follows:

- prevention of air pollution by exhaust gas (particles, COx, NOx, SOx) by means of low emission engines, use of low sulphur content fuels and incinerators
- use of refrigerants and fixed fire fighting means with zero ozone depleting potential and low global warming potential
- control of release of refrigerants to the atmosphere by means of leak detection and evacuation systems
- recovery of vapours emitted from cargo systems of ships carrying dangerous liquid cargoes in bulk.

Note 1: For ships with the service notation **oil tanker**, **combination carrier/OBO**, **combination carrier/OOC**, **chemical tanker**, **FLS tanker**, excluding those intended for the carriage of products having flashpoint > 60°C or **liquefied gas carrier**, the assignment of the notation **VCS** (Vapour Control System) is a prerequisite for the assignment of the notation **CLEAN-AIR**. However, the notation **VCS** may also be assigned as a single notation as described in [6.14.7].

6.8.4 Sea and air pollution prevention (GREEN PLUS - GREEN STAR 3 DESIGN - GREEN STAR 3 - GREEN STAR 3 (TOC)) *(1/7/2020)*

a) **GREEN PLUS**

The additional class notation **GREEN PLUS** is assigned to ships designed and provided with systems, components and procedural means to control and prevent the emission of polluting substances into the sea, the air and more in general the environment, in accordance with the requirements in Pt F, Ch 7, Sec 1.

b) **GREEN PLUS T**

The additional class notation **GREEN PLUS T** is assigned to units:

- intended to operate at a fixed location;
- provided with facilities to load and unload other units (e.g. bulk carriers, dry cargo ships carrying solid materials in bulk)

complying with the provision in a) and provided with solid bulk cargo handling systems designed to minimize their environmental impact according to Pt F, Ch 7, Sec 6.

c) **GREEN STAR 3 DESIGN**

When ships are assigned the notations **CLEAN-SEA** and **CLEAN-AIR**, the two separate notations are superseded by the cumulative additional class notation **GREEN STAR 3 DESIGN**.

d) **GREEN STAR 3**

The additional class notation **GREEN STAR 3** is assigned to ships provided with equipment and procedural means to prevent pollution of the sea and of the air. This is achieved by compliance with the applicable requirements of Annexes I to VI of MARPOL Convention, relevant to ship's liquid, solid and gas

relevant to the fire detection system is applied, the additional class notation **PMS-CM(FDS)** is assigned.

6.13.8 PMS-CM *(1/1/2020)*

Where a Planned Maintenance Scheme approved by the Society is implemented, and Condition Based Maintenance complying with the requirements of Pt F, Ch 12, Sec 7 relevant to individual items selected by the Owner is applied, the additional class notation **PMS-CM** is assigned.

6.14 Other additional class notations

6.14.1 Strengthened bottom - Not always afloat but safe aground (NAABSA) *(15/10/2019)*

The additional class notation **STRENGTHBOTTOM-NAABSA** may be assigned to ships built with specially strengthened bottom structures so as to be able to be loaded and/or unloaded when properly stranded.

The requirements for the assignment of this notation are given in Pt F, Ch 13, Sec 1.

6.14.2 Loading by grabs *(1/4/2006)*

a) The additional class notation **GRABLOADING** may be assigned to ships with hold tank tops specially reinforced for loading/unloading cargoes by means of grabs or buckets.

   The requirements for the assignment of this notation are given in Pt F, Ch 13, Sec 2.

   However, this does not preclude ships not assigned with this notation from being loaded/unloaded with grabs.

b) The additional class notation **GRAB [X]** may be assigned to ships with hold tank tops designed for loading/unloading cargoes by means of grabs having a maximum mass of [X] tonnes.

   The requirements for the assignment of this notation are given in Pt F, Ch 13, Sec 2 (see also Note 2).

Note 1: These additional class notations may only be assigned to ships with the service notation **general cargo ship** (intended to carry dry bulk cargoes), **bulk carrier**, **ore carrier**, **combination carrier/OBO** or **combination carrier/OOC**.

Note 2: The specific requirements for the assignment of the notation **GRAB [X]** to bulk carriers with the service feature **CSR** are given in the Common Structural Rules (Ch 1, Sec 1, [3]).

6.14.3 In-water survey

The additional class notation **INWATERSURVEY** may be assigned to ships provided with suitable arrangements to facilitate the in-water surveys as provided in Ch 2, Sec 2, [7.1.4].

The requirements for the assignment of this notation are given in Pt F, Ch 13, Sec 3.

6.14.4 Single point mooring

The additional class notation **SPM** (Single Point Mooring) may be assigned to ships fitted with a specific mooring installation.

The requirements for the assignment of this notation are given in Pt F, Ch 13, Sec 4.

These requirements reproduce the provisions of "Recommendations for Equipment Employed in the Mooring of Ships at Single Point Mooring" (3rd edition 1993), issued by OCIMF (Oil Companies International Marine Forum).

6.14.5 Container lashing equipment *(1/7/2017)*

The additional class notation **LASHING** is assigned to ships initially fitted with mobile container lashing equipment that is documented, tested and checked.

The notation **ROUTE DEPENDENT LASHING (start date - end date)** is assigned to ships initially fitted with mobile container lashing equipment that is documented, tested and checked for specific routes and for the period of year defined by the specification start date - end date.

These notation are assigned only to ships having the service notation **container ship** or the additional service feature **equipped for carriage of containers**.

The requirements for the assignment of the notations are given in Pt F, Ch 13, Sec 5.

This equipment, however, will not be verified any longer at the periodical class surveys to which the ship is submitted.

6.14.6 Dynamic positioning *(1/1/2021)*

a) The additional class notation **DYNAPOS** may be assigned to ships equipped with a dynamic positioning system.

   In compliance with [6.1.3], this notation is assigned a construction mark, as defined in [3].

   The additional class notation **DYNAPOS** is assigned, in accordance with [6.1.3], to ships fitted with dynamic positioning installations complying with the requirements of this Section, as follows:

   - **DYNAPOS-SAM**
   - **DYNAPOS-DP1**
   - **DYNAPOS-DP2**
   - **DYNAPOS-DP3**

   DYNAPOS-SAM (semi-automatic control): the control system of installation is to be achieved by automatic conversion of the instructions issued by the operator in thruster commands: the operator's manual intervention is necessary for position keeping.

   DYNAPOS-DP1 (automatic control): position keeping is automatically achieved and loss of position and/or heading may occur in the event of a single failure.

   DYNAPOS-DP2 (automatic control): position keeping is automatically achieved, but loss of position and/or heading is not to occur in the event of a single failure in any active component or system.

   DYNAPOS-DP3 (automatic control): position keeping is automatically achieved, but loss of position and/or heading is not to occur in the event of a single failure of any active component or system, any static component or loss of any one watertight compartment and any one fire sub-division, due to fire or flooding.

   The scope of the notation, including the additional keys for the description of capability of the installation and the requirements for assignment, are given in Pt F, Ch 13, Sec 6.

   The notations may be completed by the feature **SKC (L, I1, I2, I3, I4)**, which provides information about the position keeping ability of the ship at the most

facilities do not include hangar and refuelling or maintenance facilities.

The requirements for the assignment of these notations are given in Pt F, Ch 13, Sec 16.

6.14.20 Inert gas systems *(1/7/2016)*

The additional class notation **INERTGAS-A** may be assigned to ships having the service notation:

a) built before 1 January 2016 having the service notation:
- **oil tanker, combination carrier/OBO, combination carrier/OOC, FLS tanker**, having deadweight equal to or greater than 20,000 tonnes, or
- **chemical tanker** and **liquefied gas carrier**, having deadweight equal to or greater than 20,000 tonnes but not complying with Pt C, Ch 4, Sec 1, [8.2.4] b)

b) built on or after 1 January 2016:
- **oil tanker, combination carrier/OBO, combination carrier/OOC, FLS tanker**, having deadweight equal to or greater than 8,000 tonnes, or
- **chemical tanker** and **liquefied gas carrier**, having deadweight equal to or greater than 8,000 tonnes but not complying with Pt C, Ch 4, Sec 1, [8.2.4]

for which the installation of the inert gas system is compulsory.

The installed inert gas system is to comply with Pt C, Ch 4, Sec 1, [9] except Pt C, Ch 4, Sec 1, [9.6].

The additional class notation **INERTGAS-B** may be assigned to ships:

a) built before 1 January 2016 having the service notation:
- **oil tanker, combination carrier/OBO, combination carrier/OOC, FLS tanker**, whose deadweight is less than 20,000 tonnes, or
- **chemical tanker** and **liquefied gas carrier**, having deadweight equal to or greater than 20,000 tonnes but complying with Pt C, Ch 4, Sec 1, [8.2.4] b) or having deadweight less than 20,000 tonnes

b) built on or after 1 January 2016:
- **oil tanker, combination carrier/OBO, combination carrier/OOC, FLS tanker**, whose deadweight is less than 8,000 tonnes, or
- **chemical tanker** and **liquefied gas carrier**, having deadweight equal to or greater than 8,000 tonnes but complying with Pt C, Ch 4, Sec 1, [8.2.4] b) or having deadweight less than 8,000 tonnes

for which the installation of the inert gas system is not compulsory but fitted with an inert gas system complying with the requirements in Pt C, Ch 4, Sec 1, [9.6].

The additional class notation **INERTGAS-C** may be assigned to ships having the service notation:

a) built before 1 January 2016 having the service notation:
- **oil tanker, combination carrier/OBO, combination carrier/OOC, FLS tanker**, whose deadweight is less than 20,000 tonnes, or
- **chemical tanker** and **liquefied gas carrier**, having deadweight equal to or greater than 20,000 tonnes but complying with Pt C, Ch 4, Sec 1, [8.2.4] b) or having deadweight less than 20,000 tonnes

b) built on or after 1 January 2016:
- **oil tanker, combination carrier/OBO, combination carrier/OOC, FLS tanker**, whose deadweight is less than 8,000 tonnes, or
- **chemical tanker** and **liquefied gas carrier**, having deadweight equal to or greater than 8,000 tonnes but complying with Pt C, Ch 4, Sec 1, [8.2.4] b) or having deadweight less than 8,000 tonnes

for which the installation of the inert gas system is not compulsory but fitted with an inert gas system complying with the requirements in Pt C, Ch 4, Sec 1, [9] except Pt C, Ch 4, Sec 1, [9.6].

6.14.21 Safe return to port, orderly evacuation and abandonment (SRTP) *(1/7/2010)*

The additional class notation **SRTP** is assigned to passenger ships complying with SOLAS Regulations II-1/8-1, II-2/21 and 22 and with the "Interim Explanatory Notes for the assessment of passenger ship systems' capabilities after a fire or a flooding casualty" as per IMO MSC.1/Circ. 1369. Solutions providing an equivalent level of safety as those contained in the above-mentioned IMO MSC.1/Circ. 1369 may be accepted by the Society, on a case-by-case basis.

6.14.22 Fire Protection (FIRE) *(1/1/2020)*

The following additional class notations are assigned to ships having enhanced features relevant to fire protection:

- **FIRE**
- **FIRE-AS**
- **FIRE-MS**
- **FIRE-MS (hot-spots)**
- **FIRE-CS**.

The requirements for the assignment of these notations are given in Part F, Ch 13, Sec 17.

6.14.23 ~~Gas~~LNG Fuelled and CNG Fuelled *(1/1/2023)*

a) **~~GAS~~LNG FUELLED and CNG FUELLED**

The additional class notation **~~GAS~~LNG FUELLED or CNG FUELLED** is assigned to ships operating with liquefied or compressed natural gas, respectively, as fuel for their internal combustion engines or boilers, complying with the design and constructional requirements of:
- Pt E, Ch 9, Sec 16, for liquefied gas carriers,
- Pt C, Ch 1, App 7, for other ship types.

b) **~~GAS~~LNG FUELLED (Main) and CNG FUELLED (Main)**

The additional class notation **~~GAS~~LNG FUELLED (Main)** or **CNG FUELLED (Main)** is assigned to ships operating with liquefied or compressed natural gas, respectively, as fuel for their internal combustion main engines, complying with the design and constructional requirements of:
- Pt E, Ch 9, Sec 16, for liquefied gas carriers,
- Pt C, Ch 1, App 7, for other ship types.

c) **~~GAS~~LNG FUELLED (Aux) and CNG FUELLED (Aux)**

The additional class notation **~~GAS~~LNG FUELLED (Aux)** ~~)~~ or **CNG FUELLED (Aux)** is assigned to ships operating with liquefied or compressed natural gas, respectively, as

fuel for their internal combustion auxiliary engines, complying with the design and constructional requirements of:

- Pt E, Ch 9, Sec 16, for liquefied gas carriers,
- Pt C, Ch 1, App 7, for other ship types.

6.14.24 Carriage of specific solid cargoes in bulk *(1/8/2011)*

The additional class notation **IMSBC-A** is assigned to ships specially constructed or fitted for the carriage of cargoes belonging to Group A as defined in the IMSBC Code (see Note 1) at a moisture content in excess of their Transportable Moisture Limit (TML).

The additional class notation **IMSBC-nitrate** is assigned to ships intended for the carriage of nitrate cargoes, belonging to Group B of the IMSBC Code, for which a fixed gas fire-extinguishing system is ineffective and for which a water fire-extinguishing system is provided (see Note 2).

The additional class notation **IMSBC-non cohesive** is assigned to ships intended for the carriage of non-cohesive cargoes with an angle of repose less than or equal to 30°.

The cargoes for which each of the above notations is granted are to be listed in the Certificate of Classification.

The requirements for the assignment of these additional class notations are given in Pt F, Ch 13, Sec 18.

Note 1: International Maritime Solid Bulk Cargoes Code, IMO Resolution MSC.286(85).

Note 2: Reference is made to IMO MSC/Circ. 1146 as it may be amended.

6.14.25 Compliance with the Code of Safety for Special Purpose Ships *(1/7/2017)*

The additional class notation **SPS** is assigned to ships constructed in compliance with the requirements of the Code of Safety for Special Purpose Ships, 2008, adopted by IMO through Resolution MSC.266(84), as amended or with the requirements of the Code of Safety for Special Purpose Ships, IMO Resolution A.534(13), as amended.

6.14.26 Self-unloading *(1/1/2013)*

The additional class notation **SELF-UNLOADING** is assigned to ships having one of the following service notations:

- **bulk carrier ESP**
- **bulk carrier ESP CSR**
- **general cargo ship**

provided with permanent on-board loading and unloading equipment which complies with the following conditions:

a) the equipment that is fitted above the deck is certified in accordance with the "Rules for loading and unloading arrangements and for other lifting appliances on board ships",

b) the equipment that is fitted inside the holds (horizontal and vertical conveyors) is certified and tested in compliance with a recognised standard.

6.14.27 Technical Advisor Service (TAS) *(1/7/2013)*

The additional class notation **TAS** is assigned to ships whose approved geometry and structural data are stored in a database in order to allow the Society to provide, through dedicated computer programs, the necessary assistance in the event of damage.

6.14.28 Efficient ship (S, DWT) *(1/2/2014)*

The additional class notation **EFFICIENT SHIP (S, DWT)** is assigned to ships achieving a level of efficiency as required by Pt F, Ch 13, Sec 19.

The notation is completed by two numbers, between brackets, which represent the reference speed S and deadweight DWT at which the ship has been evaluated.

6.14.29 Mooring *(1/7/2014)*

The additional class notation **MOORING** is assigned to units provided with arrangements for permanent mooring (anchoring) at a certain location. The mooring arrangement is to comply with Pt F, Ch 13, Sec 21.

6.14.30 Cargo Handling and Personnel Lifting *(1/1/2023)*

The additional class notation **CARGO HANDLING** is assigned to a unit that is provided with crane or lifting arrangements to load and unload cargoes:

- from the unit itself to shore facilities and vice versa
- from the unit itself to another unit and vice versa (transhipment)
- from a delivery unit to a receiving unit.

The crane or lifting arrangements are to comply with the "Rules for loading and unloading arrangements and for other lifting appliances on board ships or other similar units".

The additional class notation **PERSONNEL LIFTING** is assigned to a unit that is provided with a crane or lifting arrangements intended to be used for personnel lifting and complying with the "Rules for loading and unloading arrangements and for other lifting appliances on board ships or other similar units".

The additional class notations **PERSONNEL LIFTING+** and **PERSONNEL LIFTING++** may be assigned when the crane also complies with the requirements in Pt F, Ch 13, Sec 42.

6.14.31 Navigation surrounding the arabian peninsula (SAHARA) *(1/7/2014)*

The additional class notations **C-SAHARA** and **SAHARA** are assigned to ships complying with the requirements of Pt F, Ch 13, Sec 20, intended to operate in the areas surrounding the Arabian Peninsula:

- Arabian Gulf
- Oman Gulf
- Red Sea
- Arabian Sea along the South-East Coast of the Arabian Peninsula.

The additional class notation **C-SAHARA** is assigned to ships with unrestricted navigation notation.

The additional class notation **SAHARA** is assigned to ships for which navigation in the Arabian Sea along the South-East Coast of the Arabian Peninsula is limited to sea states with significant wave height not greater than 2 meters and intended to operate only within 50 nautical miles from the shore. For these ships, according to [5.2.6], the navigation notation **special (Arabian Peninsula)** is assigned and the specific restrictions (wave height, operating distance from the shore or any specific operating area) are to be indicated.

6.14.32 Risk of failure reduction (RISK MITIGATION) *(1/1/2015)*

The additional class notation **RISK MITIGATION (...)** is assigned to ships for which additional measures are adopted in order to reduce the risk of failures in specific technical matters such as fire protection, propulsion systems, etc. which are indicated between brackets in the notation itself.

Details of the adopted measures are indicated in an annex to the Certificate of Classification of the ship.

6.14.33 Indoor Air Quality Monitoring (AIR MON) *(1/7/2015)*

The additional class notation **AIR MON** is assigned to ships for which an air quality management system is implemented and verified by the Society according to the requirements of Pt F, Ch 13, Sec 22.

6.14.34 DANGEROUS GOODS *(1/7/2015)*

The additional class notation **DANGEROUS GOODS** is assigned to ships that comply with the provisions for the carriage of dangerous goods given in SOLAS Regulation II-2/19.

6.14.35 INF 1, INF 2, INF 3 *(1/7/2015)*

The additional class notations **INF 1**, **INF 2**, **INF 3** are assigned to ships that comply with the requirements of the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-level Radioactive Wastes on Board Ships (INF Code).

The notation **INF 1** is assigned to ships that are certified to carry packaged irradiated nuclear fuel, plutonium and high-level radioactive wastes with an aggregate activity less than 4000 TBq.

The notation **INF 2** is assigned to ships that are certified to carry packaged irradiated nuclear fuel or high-level radioactive wastes with an aggregate activity less than 2 x 106 TBq and ships which are certified to carry plutonium with an aggregate activity less than 2 x 105 TBq.

The notation **INF 3** is assigned to ships that are certified to carry packaged irradiated nuclear fuel or high-level radioactive wastes and ships which are certified to carry plutonium with no restriction of the maximum aggregate activity of the materials.

6.14.36 Dedicated Oil Recovery System (DORS) *(15/7/2015)*

The additional class notation **DORS** is assigned to ships with cargo tanks and fuel oil tanks provided with two or more connectors in order to allow the recovery of the content of the tanks.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 23.

6.14.37 ~~GAS~~LNG READY (X1, X2, X3…) and CNG READY (X1, X2, X3…) *(1/1/2023)*

The additional class notation **~~GAS~~LNG READY (X1, X2, X3…)** or **CNG READY (X1, X2, X3…)** is assigned to ships whose design is in compliance with the applicable Rules for ~~Gas~~LNG and CNG Fuelled Ships, and the relevant systems and arrangement are partially installed on board, thus easing a future ship conversion into a ~~Gas~~LNG Fuelled Ship or CNG Fuelled Ship.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 24.

6.14.38 Temporary Refuge (RISKS) *(1/7/2016)*

The additional class notation **TEMPORARY REFUGE (RISKS)** is assigned to ships whose design includes specific characteristics and facilities in order to safely accommodate persons, granting temporary protection from the consequences **(RISKS)** of a possible major accident, as defined by the Designer.

The design of the temporary refuge ship is to be developed in accordance with the criteria of a recognised standard and is to include:

- the identification and quantification of the risks by the Designer and the duration of exposure to these risks,
- the assessment of its protection characteristics and capabilities effectiveness with respect to their progressive impairment,
- the adoption of an appropriate programme of tests, inspections, maintenance, repair and replacement, which contribute to the impairment detection, prevention and mitigation.

6.14.39 DOLPHIN QUIET SHIP or DOLPHIN TRANSIT SHIP *(1/3/2017)*

The additional class notations **DOLPHIN QUIET SHIP** or **DOLPHIN TRANSIT SHIP** are assigned to ships whose design is such as to ensure a low environmental impact originated from underwater noise radiation.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 25.

6.14.40 GREAT LAKES ST LAWRENCE SEAWAY *(1/7/2017)*

The additional class notation **GREAT LAKES ST LAWRENCE SEAWAY** is assigned to ships whose design and equipment is in compliance with the applicable requirements issued by issued by "The St. Lawrence Seaway Management Corporation and the Saint Lawrence Seaway Development Corporation". The relevant arrangements and equipment are recorded in the ship's status.

6.14.41 EGCS-SOX/NOX *(1/7/2017)*

The additional class notation **EGCS-SOX** and/or **EGCS-NOX** are assigned to ships equipped respectively with exhaust gas cleaning systems suitable to reduce the SOx emissions (i.e. typically scrubbers) and the NOx emissions (i.e typically Selective Catalytic Reduction systems) .

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 26.

6.14.42 BATTERY POWERED SHIPS *(1/1/2019)*

The additional class notation **BATTERY POWERED SHIPS**, is assigned to ships where batteries, other than Lead and Nickel-Cadmium batteries, having a capacity of 50 kWh or above are installed to supply essential or not-essential services and emergency services, in compliance with the requirements of Pt C, Ch 2, App 2.

6.14.43 Man Overboard Detection System (MOB) *(1/11/2018)*

The additional class notation **MOB** is assigned to ships equipped with a Man Overboard Detection System capable of

detecting persons that pass through the MOB detection zone while going overboard.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 27.

6.14.44 Hybrid Propulsion Ship (HYB-...) *(1/1/2019)*

The additional class notation **HYBRID PROPULSION SHIP (HYB-…)** is assigned to ships equipped with an hybrid propulsion system.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 28.

6.14.45 Cyber Resilience *(1/1/2019)*

The additional class notations **CYR (Cyber resilience), CYR-OT (Cyber resilience of Operational Technology)** and **CYR-IT (Cyber resilience of Information Technology)** assigned to ships complying with the cyber resilience requirements given in Pt F, Ch 13, Sec 29.

6.14.46 Digital Ship *(1/1/2023)*

The additional class notation **DIGITAL SHIP (ADC)** is assigned to ships fitted with an automatic data collection system enabling the collection of navigation and machinery data and capable of transferring ashore the data (either as collected or elaborated as necessary)~~their transmission on shore~~.

The requirements for the assignment of th~~is~~e **DIGITAL SHIP (ADC)** additional class notation are given in Pt F, Ch 13, Sec 30.

The additional class notation **DIGITAL SHIP (D)** is assigned to ships fitted with one or more approved electronic system/digital tool:

- enabling the collection on board of documentary data in place of paper copies;
- duplicated by a secondary mean or by the possibility to transmit data ashore keeping synchronized the two data storage databases;
- capable of sharing stored data with the Society.

The requirements for the assignment of the **DIGITAL SHIP (D)** additional class notation are given in Pt F, Ch 13, Sec 44.

6.14.47 AIr Lubrication System (AIR LUB) *(1/4/2019)*

The additional class notation **AIR LUB** is assigned to ships equipped with an air lubrication system according to Pt F, Ch 13, Sec 31.

An air lubrication system is an energy saving system utilizing microbubbles to reduce hull skin friction. The consistent release of microbubbles forms an air-water layer around the hull that can result in reduced skin friction for ships.

6.14.48 Persons with reduced mobility (PMR-ITA) *(13/12/2019)*

The additional class notation **PMR-ITA** is assigned to ships designed in such a way that a person with reduced mobility can embark and disembark easily and safely and that there is barrier free passage in public spaces on board and in escape routes to muster stations.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 32.

6.14.49 BIOSAFE SHIP *(15/6/2020)*

The additional class notation **BIOSAFE SHIP** is assigned to:

- Cruise ships and ro-ro passenger ships with sleeping facilities for passengers
- Passenger ships, high-speed passenger craft and ro-ro passenger ships in short sea voyages
- Cargo ships

designed and provided with systems, components and operative procedures to control and prevent possible on board infection outbreak.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 33.

6.14.50 REMOTE SURVEYABLE SHIP (REMOTE) *(1/1/2023)*

The additional class notation **REMOTE** is assigned to ships complying with the requirements given in Pt F, Ch 13, Sec 34 to facilitate the execution of remote surveys described in Ch 2, App 5.~~deemed by the Society eligible to remotely carry out the largest scope of class surveys, including periodical surveys, on the basis of:~~

- ~~their age and service;~~
- ~~their records of maintenance and operation; and,~~
- ~~the specific arrangements and qualified personnel available on board to facilitate remote surveys (see Note 1).~~

~~The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 34.~~

Note 1: ~~Remote Survey: a survey carried out by the Society without the physical attendance of the Surveyor on board,~~

6.14.51 LPG Fuelled *(1/5/2021)*

The additional class notation **LPG FUELLED** is assigned to ships operating with LPG as fuel for their internal combustion engines or boilers, complying with the design and constructional requirements of Pt C, Ch 1, App 13.

6.14.52 NH3 Fuelled *(1/5/2021)*

The additional class notation **NH3 FUELLED** is assigned to ships operating with Ammonia as fuel for their internal combustion engines or boilers, complying with the design and constructional requirements of Pt C, Ch 1, App 13.

6.14.53 NH3 FUELLED READY (X1, X2, X3) *(1/5/2021)*

The additional class notation **NH3 FUELLED READY (X1, X2, X3…)** is assigned to ships whose design is in compliance with Pt C, Ch 1, App 13, and the relevant systems and arrangement are partially installed on board, thus easing a future ship conversion into a NH3 Fuelled Ship.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 35.

6.14.54 SUSTAINABLE SHIP *(1/1/2023)*

The additional class notation **SUSTAINABLE SHIP** is assigned to ships complying with the sustainability criteria given in Pt F, Ch 13, Sec 36 relevant to:

a) design and provision of systems, components and procedural means to control and prevent the emission of polluting substances into the sea, the air and, more in general, the

environment (reference is made to **GREEN PLUS** additional class notation)

b) underwater noise limitation (reference is made to **DOLPHIN** additional class notations)

c) noise and vibration limitation on board (reference is made to **COMF-NOISE** and **COMF-VIB** additional class notations)

d) compliance with ~~**COMF-**~~**NOISE-PORT-OUT(X) or NOISE-PORT-IN(X)** additional class notations

e) compliance with **MLCDESIGN** additional class notation

f) compliance with **BIOSAFE SHIP** additional class notation

g) achievement of EEDI and EEXI values 40% lower than those in Phase 0 EEDI reference lines (see Note 1) in MARPOL Annex VI, according to the 2030 target in Initial IMO strategy on reduction of GHG emissions from ships (Res. MEPC.304(72)).

Note 1: For ro-ro cargo ships and ro-ro passenger ships, reference is made to Phase 2 EEDI reference lines

6.14.55 Maritime Autonomous Surface Ship (MASS) *(1/10/2021)*

The additional class notations **MASS** are assigned to ships having one of the following degrees of autonomy:

- **MASS-ADS**: ship with Automated processes and Decision Support: seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated and at times be unsupervised but with seafarers on board ready to take control.
- **MASS-RCM**: Remotely Controlled Manned ship: the ship is controlled and operated from another location. Seafarers are available on board to take control and to operate the shipboard systems and functions.
- **MASS-RCU**: Remotely Controlled Unmanned ship: the ship is controlled and operated from another location. There are no seafarers on board.
- **MASS-FAS**: Fully Autonomous Ship: the operating system of the ship can make decisions and determine actions by itself.

For the assignment of the additional class notations **MASS**, in its variants, the ship is to comply with the requirements given in Pt F, Ch 13, Sec 37.

6.14.56 H2 FUELLED *(1/10/2021)*

The additional class notation **H2 FUELLED** is assigned to ships using hydrogen as fuel, complying with the design and constructional requirements of Pt C, Ch 1, App 14.

6.14.57 H2 FUELLED READY (X1, X2, X3) *(1/10/2021)*

The additional class notation **H2 FUELLED READY (X1, X2, X3…)** is assigned to ships whose design is in compliance with Pt C, Ch 1, App 14, and the relevant systems and arrangement are partially installed on board, thus easing a future ship conversion into a H2 FUELLED ship.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 38.

6.14.58 METHYL/ETHYL ALCOHOL FUELLED *(1/1/2022)*

The additional class notation **METHYL/ETHYL ALCOHOL FUELLED** is assigned to ships using methyl/ethyl alcohol as fuel, complying with the design and constructional requirements of Pt C, Ch 1, App 15.

6.14.59 METHYL/ETHYL ALCOHOL FUELLED READY (X1, X2, X3) *(1/1/2022)*

The additional class notation **METHYL/ETHYL ALCOHOL FUELLED READY (X1, X2, X3…)** is assigned to ships whose design is in compliance with Pt C, Ch 1, App 15, and the relevant systems and arrangement are partially installed on board, thus easing a future ship conversion into a METHYL/ETHYL ALCOHOL FUELLED ship.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 39.

6.14.60 ENHANCED MAINTENANCE (EM) *(1/11/2022)*

The additional class notation **ENHANCED MAINTENANCE (EM)** is assigned to ships subject to enhanced maintenance including:

- a three-dimensional model structural analysis performed for the hull,
- a Planned Maintenance Scheme (PMS) approved by the Society enhanced by a risk analysis of the essential systems, and
- periodical and corrective maintenance, as well as periodical and occasional surveys of hull structures and equipment performed according to approved procedures included in the Inspection and Maintenance Plan (IMP), together with audits at the Owner's office.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 40.

6.14.61 FUEL CELL POWERED SHIP *(1/1/2023)*

The additional class notation **FUEL CELL POWERED SHIP** is assigned to ships where fuel cells are installed to supply essential or not-essential services, in compliance with the design and constructional requirements of Pt C, Ch 2, App 3, as follows:

- **FUEL CELL POWERED SHIP (E)** when fuel cell is used to power at least one of the essential services defined in Pt C, Ch 2, Sec 1, [3.2.1] and contributes to the compliance of the main source of electrical power to the requirements in Ch 2, Sec 3, [2.2.3]
- **FUEL CELL POWERED SHIP (NE)** when fuel cell is used to power only services not falling under the definition of essential services in Pt C, Ch 2, Sec 1, [3.2.1].

6.14.62 Reduced Weight of anchor (RW) and Super Reduced Weight of anchor (SRW) *(1/1/2023)*

The additional class notations **RW** or **SRW** may be assigned to ships using high holding power (HHP) anchors or super high holding power (SHHP) anchors as defined in Pt B, Ch 10, Sec 4, [3.2.3], respectively.

The reduction in the weight of anchors is to comply with the requirements in Pt B, Ch 10, Sec 4, [3.2.3].

6.14.63 NOx-Tier III *(1/1/2023)*

The additional class notation **NOx-Tier III** may be assigned to ships having all marine diesel engines with power output greater than 130 kW - other than those exempted as per Para 1.2 of Reg. 13 of MARPOL Annex VI, as applicable - certified for compliance with Para 5.1 of Reg. 13 of MARPOL Annex VI and pro-

vided with an approved NOx Technical File and Engine International Air Pollution (EIAPP) certification.

6.14.64 EEDI-Ph3 *(1/1/2023)*

The additional class notation **EEDI-Ph3** may be assigned to ships whose verified attained Energy Efficiency Design Index (EEDI) value is less than or equal to the required value for EEDI Phase 3 in Reg.24 of MARPOL Annex VI, as amended by IMO Resolution MEPC.328(76).

6.14.65 Cargo Piping Protected (CPP) *(1/1/2023)*

The additional class notation **CPP** is assigned to ships having all cargo piping and valve control piping located above the double bottom and complying with the requirements for the assignment of this notation given in Pt F, Ch 13, Sec 41.

6.14.66 Coating performance standard in cargo oil tanks (CPS-COT) *(1/1/2023)*

The additional class notation **CPS-COT** is assigned to crude oil tankers surveyed during construction by the Society, whose cargo oil tanks have been provided with protective coatings complying with the requirements for the assignment of this notation given in Pt F, Ch 13, Sec 43.

6.14.67 FUEL SAMPLING *(1/1/2023)*

The additional class notation **FUEL SAMPLING** is assigned to ships having the fuel oil supply system provided with sampling points complying with the requirements in Pt C, Ch 1, Sec 10, [11.10.5] and the additional ones in Pt F, Ch 13, Sec 45.

7 Other notations

7.1

7.1.1 The Society may also define other notations by means of provisional requirements and guidelines, which may then be published in the form of tentative rules.

Table 3 : List of additional class notations *(1/1/2023)*

Additional class notation	Reference for definition	Reference	Remarks
AIR LUBRICATION SYSTEM (AIR LUB)	[6.14.47]	Pt F, Ch 13, Sec 31	
AIR-MON	[6.14.33]	Pt F, Ch 13, Sec 22	
AUT-CCS	[6.4.3]	Pt F, Ch 3, Sec 2	**(1)**
AUT-PORT	[6.4.4]	Pt F, Ch 3, Sec 3	**(1)**
AUT-UMS	[6.4.2]	Pt F, Ch 3, Sec 1	**(1)**
AVM-APS or AVM-APS-NS	[6.3.2]	Pt F, Ch 2, Sec 1	**(1)**
AVM-IAPS	[6.3.3]	Pt F, Ch 2, Sec 2	**(1)**
AVM-DPS or AVM-DPS-NS	[6.3.4]	Pt F, Ch 2, Sec 3	**(1)**
AVM-IPS	[6.3.5]	Pt F, Ch 2, Sec 4	**(1)**
BATTERY POWERED SHIPS	[6.14.42]	Pt C, Ch 2, App 2	
BIOSAFE SHIP	[6.14.49]	Pt F, Ch 13, Sec 33	
BWM-E	[6.14.15]	Pt C, Ch 1, Sec 10, [7]	**(5)**
BWM-T	[6.14.15]	Pt C, Ch 1, App 8	
CARGOCONTROL	[6.14.9]	Pt F, Ch 13, Sec 9	
CARGO HANDLING	[6.14.30]	NA	
CARGO PIPING PROTECTED (CPP)	[6.14.65]	Pt F, Ch 13, Sec 41	
CLEAN-AIR	[6.8.3]	Pt F, Ch 7, Sec 3	**(4)**
CLEAN-SEA	[6.8.2]	Pt F, Ch 7, Sec 4	**(4)**
COAT-WBT	[6.14.12]	Pt F, Ch 13, Sec 12	
COATING PERFORMANCE STANDARD IN CARGO OIL TANKS (CPS-COT)	[6.14.66]	Pt F, Ch 13, Sec 43	

(1) A construction mark is added to this notation.
(2) This notation may be completed by the specific notations **-PRECOOLING**, **-QUICKFREEZE** and/or **-AIRCONT** (see [6.9.5]).
(3) This notation may be completed by the specific notations **-MIDSHIP** and **-TRANSFER** (see [6.14.7]).
(4) When ships are assigned the notations **CLEAN-SEA** and **CLEAN-AIR**, the two separate notations are superseded by the cumulative additional class notation **GREEN STAR 3 DESIGN** (see [6.8.4]).
(5) This notation may be completed by the specific features: **sequential, flow-through, dilution**.
(6) This notation may be completed by the specific notation **-HULL** (see [6.10.4]).
(7) This notation may be completed by the specific notation **Icebreaker** (see [6.11.1]).

Additional class notation	Reference for definition	Reference	Remarks
COMF-AIR	[6.7.4]	Pt F, Ch 6, Sec 3	
COMF-NOISE	[6.7.2]	Pt F, Ch 6, Sec 1	
COMF-VIB	[6.7.3]	Pt F, Ch 6, Sec 2	
COVENT	[6.14.8]	Pt F, Ch 13, Sec 8	
CYBER RESILIENCE (CYR, CYR-OT and CYR-IT)	[6.14.45]	Pt F, Ch 13, Sec 29	
DANGEROUS GOODS	[6.14.34]	NA	
DIGITAL SHIP (ADC)	[6.14.46]	Pt F, Ch 13, Sec 30	
DIGITAL SHIP (D)	[6.14.46]	Pt F, Ch 13, Sec 44	
DIVINGSUPPORT	[6.14.17]	Pt F, Ch 13, Sec 14	
DOLPHIN QUIET- SHIP or DOLPHIN TRANSIT SHIP	[6.14.39]	Pt F, Ch 13, Sec 25	
DORS	[6.14.36]	Pt F, Ch 13, Sec 23	
DMS	[6.14.11]	Pt F, Ch 13, Sec 11	
DYNAPOS	[6.14.6] a)	Pt F, Ch 13, Sec 6	**(1)**
DP PLUS	[6.14.6] b)	Pt F, Ch 13, Sec 6	
EEDI-Ph3	[6.14.64]	NA	
EGCS-SOX and/or EGCS-NOX	[6.14.41]	Pt F, Ch 13, Sec 26	
EFFICIENT SHIP (S, DWT)	[6.14.28]	Pt F, Ch 13, Sec 19	
ENHANCED MAINTENANCE (EM)	[6.14.60]	Pt F, Ch 13, Sec 40	
FATIGUELIFE (Y)	[6.14.13]	NA	
FIRE	[6.14.22]	Pt F, Ch 13, Sec 17	
FIRE-AS	[6.14.22]	Pt F, Ch 13, Sec 17	
FIRE-MS	[6.14.22]	Pt F, Ch 13, Sec 17	
FIRE-MS (hot-spots)	[6.14.22]	Pt F, Ch 13, Sec 17	
FIRE-CS	[6.14.22]	Pt F, Ch 13, Sec 17	
FUEL CELL POWERED SHIP (E) **FUEL CELL POWERED SHIP (NE)**	[6.14.61]	Pt C, Ch 2, App 3	
FUEL SAMPLING	[6.14.67]	Pt F, Ch 13, Sec 45	
GRABLOADING and GRAB (X)	[6.14.2]	Pt F, Ch 13, Sec 2	
GREAT LAKES ST LAWRENCE SEAWAY	[6.14.41]	NA	
GREEN PLUS	[6.8.4] a)	Pt F, Ch 7, Sec 1	
GREEN PLUS T	[6.8.4] b)	Pt F, Ch 7, Sec 1 and Pt F, Ch 7, Sec 6	
GREEN STAR 3 DESIGN	[6.8.4] c)	Pt F, Ch 7, Sec 2	This cumulative notation supersedes the notations **CLEAN-SEA** and **CLEAN-AIR**, when both are assigned
GREEN STAR 3	[6.8.4] d)	Pt F, Ch 7, Sec 5	
GREEN STAR 3 (TOC)	[6.8.4] e)	-	
GC CARGO HANDLING	[6.8.5]	Pt F, Ch 7, Sec 6	
H2 FUELLED	[6.14.56]	Pt C, Ch 1, App 14	

(1) A construction mark is added to this notation.

(2) This notation may be completed by the specific notations **-PRECOOLING**, **-QUICKFREEZE** and/or **-AIRCONT** (see [6.9.5]).

(3) This notation may be completed by the specific notations **-MIDSHIP** and **-TRANSFER** (see [6.14.7]).

(4) When ships are assigned the notations **CLEAN-SEA** and **CLEAN-AIR**, the two separate notations are superseded by the cumulative additional class notation **GREEN STAR 3 DESIGN** (see [6.8.4]).

(5) This notation may be completed by the specific features: **sequential, flow-through, dilution**.

(6) This notation may be completed by the specific notation **-HULL** (see [6.10.4]).

(7) This notation may be completed by the specific notation **Icebreaker** (see [6.11.1]).

Additional class notation	Reference for definition	Reference	Remarks
H2 FUELLED READY (X1, X2, X3)	[6.14.57]	Pt F, Ch 13, Sec 38	
HELIDECK	[6.14.19]	Pt F, Ch 13, Sec 16	
HELIDECK-H	[6.14.19]	Pt F, Ch 13, Sec 16	
HYBRID PROPULSION SHIP (HYB-…)	[6.14.44]	Pt F, Ch 13, Sec 28	**(1)**
HVSC	[6.14.18]	Pt F, Ch 13, Sec 15	
HVSC-NB	[6.14.18]	Pt F, Ch 13, Sec 15	
ICE	[6.10.5]	-	
ICE CLASS IA	[6.10.2]	Part F, Chapter 9	**(6)**
ICE CLASS IA SUPER	[6.10.2]	Part F, Chapter 9	**(6)**
ICE CLASS IB	[6.10.2]	Part F, Chapter 9	**(6)**
ICE CLASS IC	[6.10.2]	Part F, Chapter 9	**(6)**
ICE CLASS ID	[6.10.3]	Part F, Chapter 9	**(6)**
IMSBC-A	[6.14.24]	Pt F, Ch 13, Sec 18	
IMSBC-nitrate	[6.14.24]	Pt F, Ch 13, Sec 18	
IMSBC-non cohesive	[6.14.24]	Pt F, Ch 13, Sec 18	
INERTGAS-A	[6.14.20]	Pt C, Ch 4, Sec 1	
INERTGAS-B	[6.14.20]	Pt C, Ch 4, Sec 1	
INERTGAS-C	[6.14.20]	Pt C, Ch 4, Sec 1	
INWATERSURVEY	[6.14.3]	Pt F, Ch 13, Sec 3	
INF 1, INF 2, INF 3	[6.14.35]	NA	**(1)**
LASHING	[6.14.5]	Pt F, Ch 13, Sec 5	
~~GAS~~LNG FUELLED or **CNG FUELLED**	[6.14.23] a)	Pt C, Ch 1, App 7 and Pt E, Ch 9, Sec 16	
~~GAS~~LNG FUELLED (Main) or **CNG FUELLED (Main)**	[6.14.23] b)	Pt C, Ch 1, App 7 and Pt E, Ch 9, Sec 16	
~~GAS~~LNG FUELLED (Aux) or **CNG FUELLED (Aux)**	[6.14.23] c)	Pt C, Ch 1, App 7 and Pt E, Ch 9, Sec 16	
~~GAS~~LNG READY (X1, X2, X3…) or **CNG READY (X1, X2, X3…)**	[6.14.37]	Pt F, Ch 13, Sec 24	
LPG FUELLED	[6.14.51]	Pt C, Ch 1, App 13	
MAN OVERBOARD DETECTION SYSTEM (MOB)	[6.14.43]	Pt F, Ch 13, Sec 27	
MANOVR	[6.14.10]	Pt F, Ch 13, Sec 10	
MASS-ADS **MASS-RCM** **MASS-RCU** **MASS-FAS**	[6.14.55]	Pt F, Ch 13, Sec 37	
METHYL/ETHYL ALCOHOL FUELLED	[6.14.58]	Pt C, Ch 1, App 15	

(1) A construction mark is added to this notation.

(2) This notation may be completed by the specific notations **-PRECOOLING**, **-QUICKFREEZE** and/or **-AIRCONT** (see [6.9.5]).

(3) This notation may be completed by the specific notations **-MIDSHIP** and **-TRANSFER** (see [6.14.7]).

(4) When ships are assigned the notations **CLEAN-SEA** and **CLEAN-AIR**, the two separate notations are superseded by the cumulative additional class notation **GREEN STAR 3 DESIGN** (see [6.8.4]).

(5) This notation may be completed by the specific features: **sequential, flow-through, dilution**.

(6) This notation may be completed by the specific notation **-HULL** (see [6.10.4]).

(7) This notation may be completed by the specific notation **Icebreaker** (see [6.11.1]).

Additional class notation	Reference for definition	Reference	Remarks
METHYL/ETHYL ALCOHOL FUELLED READY (X1, X2, X3)	[6.14.59]	Pt F, Ch 13, Sec 39	
MLCDESIGN	[6.14.16]	Pt F, Ch 13, Sec 13	
MON-HULL	[6.6.2]	Pt F, Ch 5, Sec 1	
MON-SHAFT	[6.6.3]	Pt F, Ch 5, Sec 2	
MOORING	[6.14.29]	Pt F, Ch 13, Sec 21	
NH3 FUELLED	[6.14.52]	Pt C, Ch 1, App 13	
NH3 FUELLED READY (X1, X2, X3)	[6.14.53]	Pt F, Ch 13, Sec 35	
NOx-Tier III	[6.14.63]	NA	
~~**COMF-**~~**NOISE-PORT-OUT(X)** **NOISE-PORT-IN(X)**	[6.7.5]	Pt F, Ch 6, Sec 4	
PERSONNEL LIFTING	[6.14.30]	Pt F, Ch 13, Sec 42	
PERSONS WITH REDUCED MOBILITY (PMR-ITA)	[6.14.48]	Pt F, Ch 13, Sec 32	
PMA	[6.14.14]	NA	
PMS	[6.13.2]	Pt F, Ch 12, Sec 1	
PMS-CM(PROP)	[6.13.3]	Pt F, Ch 12, Sec 2	
PMS-CM(HVAC)	[6.13.4]	Pt F, Ch 12, Sec 3	
PMS-CM(CARGO)	[6.13.5]	Pt F, Ch 12, Sec 4	
PMS-CM(ELE)	[6.13.6]	Pt F, Ch 12, Sec 5	
PMS-CM(FDS)	[6.13.7]	Pt F, Ch 12, Sec 6	
PMS-CM	[6.13.8]	Pt F, Ch 12, Sec 7	
POLAR CLASS	[6.11.1]	Part F, Chapter 10	**(7)**
REDUCED WEIGHT OF ANCHOR (RW) AND SUPER REDUCED WEIGHT OF ANCHOR (SRW)	[6.14.62]	NA	
REF-CARGO	[6.9.2]	Pt F, Ch 8, Sec 2	**(1) (2)**
REF-CONT	[6.9.3]	Pt F, Ch 8, Sec 3	**(1) (2)**
REF-STORE	[6.9.4]	Pt F, Ch 8, Sec 4	**(1) (2)**
REMOTE SURVEYABLE SHIP (REMOTE)	[6.14.50]	Pt F, Ch 13, Sec 34	
RISK MITIGATION (...)	[6.14.33]	NA	
ROUTE DEPENDENT LASHING (start date - end date)	[6.14.5]	Pt F, Ch 13, Sec 5	
SAHARA **SAHARA**	[6.14.31]	Pt F, Ch 13, Sec 20	
SELF-UNLOADING	[6.14.26]	NA	
SPM	[6.14.4]	Pt F, Ch 13, Sec 4	
SPS	[6.14.25]	NA	
SRTP	[6.14.21]	NA	

(1) A construction mark is added to this notation.

(2) This notation may be completed by the specific notations **-PRECOOLING**, **-QUICKFREEZE** and/or **-AIRCONT** (see [6.9.5]).

(3) This notation may be completed by the specific notations **-MIDSHIP** and **-TRANSFER** (see [6.14.7]).

(4) When ships are assigned the notations **CLEAN-SEA** and **CLEAN-AIR**, the two separate notations are superseded by the cumulative additional class notation **GREEN STAR 3 DESIGN** (see [6.8.4]).

(5) This notation may be completed by the specific features: **sequential, flow-through, dilution**.

(6) This notation may be completed by the specific notation **-HULL** (see [6.10.4]).

(7) This notation may be completed by the specific notation **Icebreaker** (see [6.11.1]).

Additional class notation	Reference for definition	Reference	Remarks
STAR	[6.2.4]	Part F, Chapter 1	This cumulative notation supersedes the notations **STAR-HULL** and **STAR-MACH**, when both are assigned
STAR-HULL	[6.2.2]	Pt F, Ch 1, Sec 1	
STAR-MACH	[6.2.3]	Pt F, Ch 1, Sec 2	
STRENGTHBOTTOM-NAABSA	[6.14.1]	Pt F, Ch 13, Sec 1	
SUSTAINABLE SHIP	[6.14.54]	Pt F, Ch 13, Sec 36	
SYS-COM	[6.5.4]	Pt F, Ch 4, Sec 3	
SYS-IBS	[6.5.3]	Pt F, Ch 4, Sec 2	**(1)**
SYS-NEQ **SYS-NEQ-1**	[6.5.2]	Pt F, Ch 4, Sec 1	**(1)**
TAS	[6.14.27]	NA	
TEMPORARY REFUGE (RISKS)	[6.14.38]	NA	
VCS	[6.14.7]	Pt F, Ch 13, Sec 7	**(3)**
WINTERIZATION (temp)	[6.12.1]	Part F, Chapter 11	

(1) A construction mark is added to this notation.

(2) This notation may be completed by the specific notations **-PRECOOLING**, **-QUICKFREEZE** and/or **-AIRCONT** (see [6.9.5]).

(3) This notation may be completed by the specific notations **-MIDSHIP** and **-TRANSFER** (see [6.14.7]).

(4) When ships are assigned the notations **CLEAN-SEA** and **CLEAN-AIR**, the two separate notations are superseded by the cumulative additional class notation **GREEN STAR 3 DESIGN** (see [6.8.4]).

(5) This notation may be completed by the specific features: **sequential, flow-through, dilution**.

(6) This notation may be completed by the specific notation **-HULL** (see [6.10.4]).

(7) This notation may be completed by the specific notation **Icebreaker** (see [6.11.1]).

SECTION 2 MAINTENANCE OF CLASS

1 General principles of surveys

1.1 Survey types

1.1.1 Classed ships are submitted to surveys for the maintenance of class. These surveys include the class renewal survey, intermediate and annual survey, bottom survey (either survey in dry condition or in-water survey), tailshaft survey, boiler survey, and surveys for the maintenance of additional class notations, where applicable. Such surveys are carried out at the intervals and under the conditions laid down in this Section. In addition to the above periodical surveys, ships are to be submitted to occasional surveys whenever the circumstances so require; refer to [11].

1.1.2 The different types of periodical surveys are summarised in Tab 1. The intervals at which the periodical surveys are carried out are given in the items referred to in the second column of Tab 1. The relevant extent and scope are given in Chapter 3 and Chapter 4 for all ships and for service notations, respectively, while surveys related to additional class notations are given in Chapter 5.

Where there are no specific survey requirements for additional class notations assigned to a ship, equipment and/or arrangements related to these additional class notations are to be examined, as applicable, to the Surveyor's satisfaction at each class renewal survey for the main class.

The surveys are to be carried out in accordance with the relevant requirements in order to confirm that the hull, machinery, equipment and appliances comply with the applicable Rules and will remain in satisfactory condition based on the understanding and assumptions mentioned in Ch 1, Sec 1, [3.3].

Where the conditions for the maintenance of main class, service notations and additional class notations are not complied with, the main class and/or the service notation and/or the additional class notations as appropriate will be suspended and/or withdrawn in accordance with the applicable Rules given in Sec 3.

Note 1: It is understood that requirements for surveys apply to those items that are required according to the Rules or, even if not required, are fitted on board.

1.1.3 Unless specified otherwise, any survey other than bottom survey and tailshaft survey may be effected by carrying out partial surveys at different times to be agreed upon with the Society, provided that each partial survey is adequately extensive. The splitting of a survey into partial surveys is to be such as not to impair its effectiveness.

1.2 Change of periodicity, postponement or advance of surveys

1.2.1 The Society reserves the right, after due consideration, to change the periodicity, postpone or advance surveys, taking into account particular circumstances.

Table 1 : List of periodical surveys *(1/1/2016)*

Type of survey	Reference in this Section	Reference to scope of survey
Class renewal - hull	[4]	Ch 3, Sec 5 and Chapter 4 **(1)**
Class renewal - machinery	[4]	Ch 3, Sec 5 and Chapter 4 **(1)**
Annual - hull	[5.1]	Ch 3, Sec 3 and Chapter 4 **(1)**
Annual - machinery	[5.1]	Ch 3, Sec 3 and Chapter 4 **(1)**
Intermediate - hull	[6.1]	Ch 3, Sec 4 and Chapter 4 **(1)**
Intermediate - machinery	[6.1]	Ch 3, Sec 4 and Chapter 4 **(1)**
Bottom - dry condition	[7.1]	Ch 3, Sec 6
Bottom - in water	[7.1]	Ch 3, Sec 6
Shaft - Method 1,2,3,4	[8.1]	Ch 3, Sec 7
Boiler - complete	[9.1]	Ch 3, Sec 8
(1) As applicable, according to the service notation assigned to the ship		

1.2.2 *(1/7/2020)*

When a survey becomes overdue during a voyage, the following applies:

a) In the case of a class renewal survey, the Society may, under exceptional circumstances, grant an extension to allow for completion of this survey provided there is documented agreement to such an extension prior to the expiry date of the Certificate of Classification, adequate arrangements have been made for the attendance of the Surveyor at the first port of call and the Society is satisfied that there is technical justification for such an extension. Such an extension will be granted only until arrival at the first port of call after the expiry date of the Certificate of Classification

b) In the case of annual and intermediate surveys, no postponement is granted. Such surveys are to be completed within their prescribed windows; see [2.1.3]

c) In the case of all other periodical surveys and conditions of class, extension of class may be granted until the arrival of the ship at the port of destination.

1.3 Extension of scope of survey

1.3.1 The Society and/or its Surveyors may extend the scope of the provisions in Chapter 3 to Chapter 5, which set forth the technical requirements for surveys, whenever and so far as considered necessary, or modify them in the case of special ships or systems.

1.3.2 The extent of any survey also depends upon the condition of the ship and its equipment. Should the Surveyor have any doubt as to the maintenance or condition of the ship or its equipment, or be advised of any deficiency or damage which may affect the class, then further examination and testing may be conducted as considered necessary.

1.4 General procedure of survey

1.4.1 The general procedure of survey consists in:

- an overall examination of the parts of the ship covered by the rule requirements
- checking selected items covered by the rule requirements
- attending tests and trials where applicable and deemed necessary by the Surveyor.

1.4.2 The Society's survey requirements cannot be considered as a substitute for specification and acceptance of repairs and maintenance, which remain the responsibility of the Owner.

1.4.3 In accordance with the provisions of Ch 1, Sec 1, [3.1.5], the Society will, at the request of the Owner, apply the regulations of Administrations concerning the scope and periodicity of surveys when they differ from those laid down in Part A.

1.4.4 During the surveys, the Surveyor does not check that the spare parts are kept on board, maintained in working order and suitably protected and lashed.

1.4.5 *(1/7/2006)*

As a general rule, all materials, machinery, boilers, auxiliary installations, equipment, items etc. (generally referred to as "products") which are covered by the class and used or fitted on board ships inspected by the Society during surveys after construction are to be new and, where intended for essential services as defined in Ch 1, Sec 1, [1.2.1], tested by the Society.

Second hand materials, machinery, appliances and items may be used subject to the specific agreement of the Society and the Owner.

The requirements for the selection of materials to be used in the construction or repair of the various parts of existing ships, the characteristics of products to be used for such parts and the checks required for their acceptance are to be as stated in Part C and Part D, as applicable, or in other Parts of the Rules or as specified on approved plans. In particular, the testing of products manufactured according to quality assurance procedures approved by the Society and the approval of such procedures are governed by the requirements of Pt D, Ch 1, Sec 1, [3].

1.5 Appointment of another Surveyor

1.5.1 In compliance with the provisions of Ch 1, Sec 1, [2.5.1], should a disagreement arise between the Owner and the Surveyor during a survey, the Society may, at the request of the Owner, designate another Surveyor.

2 Definitions and procedures related to surveys

2.1 General

2.1.1 Period of class

Period of class means the period starting either from the date of the initial classification, see Sec 1, [5], or from the credited date of the last class renewal survey, and expiring at the limit date assigned for the next class renewal survey.

2.1.2 Anniversary date

Anniversary date means the day of the month of each year in the period of class which corresponds to the expiry date of the period of class.

2.1.3 Survey time window

Survey time window, or more simply window, mean the fixed period during which annual and intermediate surveys are to be carried out.

2.1.4 Overdue surveys *(1/7/2001)*

Each periodical survey is assigned a limit date specified by the relevant requirements of the Rules (end of survey interval or end date of window) by which it is to be completed.

A survey becomes overdue when it has not been completed by its limit date.

Examples:

- Anniversary date: 15th April

  The 2000 annual survey can be validly carried out from 16th January 2000 to 15th July 2000. If not completed by 15th July 2000, the annual survey becomes overdue.

- Last bottom survey 20th October 2000 (periodicity 2.5 years, with a maximum interval between successive examinations not exceeding 3 years)

  The next bottom survey is to be carried out before 20th October 2003. If not completed by 20th October 2003, the bottom survey becomes overdue.

2.1.5 Conditions of class *(1/7/2020)*

A condition of class is a requirement to the effect that specific measures, repairs and/or surveys are to be carried out within a specific time limit in order to retain classification. A condition of class is pending until it is cleared. Where it is not cleared by its limit date, the condition of class is overdue.

2.1.6 Memoranda *(1/7/2020)*

Those defects and/or deficiencies which do not affect the maintenance of class and which may therefore be cleared at the Owner's convenience and any other information deemed noteworthy for the Society's convenience are indicated as memoranda. Memoranda are not to be regarded as conditions of class.

2.1.7 Exceptional circumstances *(1/7/2005)*

Exceptional circumstances' means unavailability of dry-docking facilities; unavailability of repair facilities; unavailability of essential materials, equipment or spare parts; or delays incurred by action taken to avoid severe weather conditions.

2.1.8 Force Majeure *(1/7/2005)*

'Force Majeure' means damage to the ship; unforeseen inability of the Society to attend the ship due to government restrictions on right of access or movement of personnel; unforeseeable delays in port or inability to discharge cargo due to unusually lengthy periods of severe weather, strikes or civil strife; acts of war; or other force majeure.

2.1.9 Remote surveys *(1/1/2023)*

Remote Survey is a process of verifying that a ship and its equipment are in compliance with the Rules where the verification is undertaken, or partially undertaken, without attendance on board by a Surveyor.

Note 1: Remote classification activities not requiring a survey, such as some administrative tasks, are not to be considered as remote surveys.

2.2 Terminology related to hull survey

2.2.1 Common Structural Rules *(1/7/2015)*

Where in these Rules the term "Common Structural Rules" is used, the pertinent edition of the Common Structural Rules is to be applied as follows:

- for bulk carriers, having notation "**bulk carrier ESP CSR**", contracted for construction on or after 1 April 2006 but before 1 July 2015, reference is to be made to the "Common Structural Rules for Bulk Carriers" in force at the date of contract for construction;
- for oil tankers, having notation "**oil tanker ESP CSR**", contracted for construction on or after 1 April 2006 but before 1 July 2015, reference is to be made to the "Common Structural Rules for Double Hull Oil Tankers" in force at the date of contract for construction; and
- for bulk carriers, having notation "**bulk carrier ESP CSR**" and oil tankers, having notation "**oil tanker ESP CSR**", contracted for construction on or after 1 July 2015, reference is to be made to the "Common Structural Rules for Bulk Carriers and Oil Tankers" in force at the date of contract for construction.

2.2.2 Ballast tanks *(1/1/2023)*

a) Ships with the ESP notation:

  As far as oil tankers and chemical tankers are concerned, a Ballast Tank is a tank which is used primarily~~solely~~ for the carriage of salt water ballast.

  As far as oil tankers and chemical tankers are concerned, a Combined Cargo/Ballast Tank is a tank which is used for the carriage of cargo or ballast water as a routine part of the vessel's operation and will be treated as a Ballast Tank. Cargo tanks in which water ballast might be carried only in exceptional cases according to MARPOL I/18.3 are to be treated as cargo tanks.

  As far as bulk carriers are concerned, a Ballast Tank is a tank which is used solely for salt water ballast, or, where applicable, a space which is used for both cargo and ballast will be treated as a Ballast tank when substantial corrosion has been found in that space.

  As far as double skin bulk carriers are concerned, a Ballast Tank is a tank which is used solely for salt water ballast, or, where applicable, a space which is used for both cargo and ballast will be treated as a Ballast tank when substantial corrosion has been found in that space. A Double Side Tank is to be considered as a separate tank even if it is in connection with either the topside tank or the hopper side tank.

b) Other ships:

  A Ballast Tank is a tank that is being used primarily for salt water ballast.

2.2.3 Spaces *(1/1/2008)*

Spaces are separate compartments including holds, tanks, cofferdams and void spaces bounding cargo holds, decks and the outer hull.

2.2.4 Overall survey

An overall survey is a survey intended to report on the overall condition of the hull structure and determine the extent of additional close-up surveys.

2.2.5 Close-up survey

A close-up survey is a survey where the details of structural components are within the close visual inspection range of the Surveyor, i.e. normally within reach of hand.

Classification or an attachment to the Certificate of Classification and/or class survey status or report.

2.14.5 Notification of conditions of class *(1/7/2020)*

Owners will be notified of these dates and that the vessel's class will be subject to a suspension procedure if the item is not dealt with, or postponed, by the due date (refer to Sec 3, [1.2.12]).

2.14.6 Clearance of conditions of class *(1/7/2020)*

Clearance of conditions of class is to be supported by a survey report giving details of all associated repairs and/or renewals, or of the supplemental surveys carried out. Repairs carried out are to be reported with identification of:

a) compartment and location

b) structural member

c) repair method

d) repair extent

e) NDT/Tests.

2.14.7 Conditions of class partially dealt with *(1/7/2020)*

Partially dealt with conditions of class are be supported by a survey report giving details of repairs and/or renewals, or of that part of the supplemental surveys carried out and those parts remaining outstanding.

2.15 Remote surveys

2.15.1 *(1/1/2023)*

For carrying out remote surveys the requirements in App 5 are to be complied with.

3 Certificate of Classification: issue, validity, endorsement and renewal

3.1 Issue of Certificate of Classification

3.1.1 *(1/1/2001)*

A Certificate of Classification, bearing the class notations assigned to the ship and an expiry date, is issued to any classed ship.

3.1.2 *(1/1/2001)*

A Provisional Certificate of Classification may serve as a Certificate of Classification in some cases, such as after an admission to class survey, or when the Society deems it necessary.

3.1.3 *(1/1/2001)*

The Certificate of Classification or Provisional Certificate of Classification is to be made available to the Society's Surveyors upon request.

3.2 Validity of Certificate of Classification, maintenance of class

3.2.1 According to Ch 1, Sec 1, [2.4], the Society alone is qualified to confirm the class of the ship and the validity of its Certificate of Classification.

3.2.2 During the class period, a Certificate of Classification is valid when it is not expired.

The class is maintained during a certain period or at a given date, when during the said period or at such date the conditions for suspension or withdrawal of class are not met.

3.2.3 At the request of the Owner, a statement confirming the maintenance of class may be issued by the Society based on the information in its records for that ship at the time.

This statement is issued on the assumption that the Owner has complied with the Rules, in particular with [11].

Should any information which would have prevented the Society from issuing the statement and which was not available at the time subsequently come to light, the statement may be cancelled.

Attention is drawn to Sec 3, [1.2], whereby the Society, upon becoming aware of a breach of the Rules, is empowered to suspend class from the date of the breach, which may be prior to the date of the statement.

3.2.4 *(1/7/2020)*

According to the same conditions as in [3.2.3], a statement declaring that the class is maintained "clean and free from condition of class'' may be issued by the Society when there is no pending condition of class at that date.

3.2.5 Classification-related documents and information are liable to be invalidated by the Society whenever their object is found to differ from that on which they were based or to be contrary to the applicable requirements. The Owner is liable for any damage which may be caused to any third party from improper use of such documents and information.

3.3 Endorsements of Class

3.3.1 Purpose of endorsements *(1/7/2011)*

The endorsements of class give official evidence of:

a) class surveys carried out,

b) class validity, and

c) conditions imposed and/or main items out of service (if any).

3.3.2 Direct endorsement of the Certificate of Classification *(1/7/2011)*

The Certificate of Classification is directly endorsed before the vessel sails where an annual, intermediate or class renewal survey is completed, using the appropriate section of the Certificate of Classification.

A section is also available to record postponement of the class renewal survey.

3.3.3 Class Survey Endorsement Sheet *(1/7/2011)*

In addition to the direct endorsement of the Certificate of Classification as described in [3.3.2], a Class Survey

APPENDIX 5 REMOTE SURVEYS

1 General

1.1 Application

1.1.1 *(1/1/2023)*

This Appendix contains principles and requirements for carrying out remote surveys.

Remote survey will only be appropriate provided the level of assurance is not compromised, and the survey is carried out with the same effectiveness as and is equivalent to, a survey carried out with attendance on board by a Surveyor.

These requirements apply to all vessels, self-propelled or not. These requirements are not mandatory for offshore units.

1.2 Definitions

1.2.1 Remote Survey *(1/1/2023)*

A Remote Survey is a process of verifying that a ship and its equipment are in compliance with the Rules where the verification is undertaken, or partially undertaken, without attendance on board by a Surveyor.

1.2.2 Information and Communication Technology (ICT) *(1/1/2023)*

Information and Communication Technology (ICT) are the technologies used in the scope of remote surveys for gathering, storing, retrieving, processing, analysing, and transmitting information which includes both software and hardware.

Note 1: 'Attendance on board by a surveyor' means physical attendance on board the ship by a surveyor.

Note 2: Remote classification activities not requiring a survey, such as some administrative tasks, are not to be considered as remote surveys.

Note 3: An administrative task is a task where a survey decision is not being made, for example reissue of a certificate or record following a correction, or an update to the ship's records held by the Classification Society or a document review.

2 Requirements for equivalency

2.1 General

2.1.1 *(1/1/2023)*

The requirements for equivalency of a remote survey to a survey attended on board by a Surveyor include:

- eligibility of the remote survey
- qualification of Surveyors
- planning of the remote survey
- performance of the remote survey
- assessment of the remote survey
- reporting

Equivalency is obtained when, with the use of available ICT, a Surveyor can perform a survey remotely being able to:

- obtain the supporting and technical evidence required according to the applicable rules
- verify applicable survey items and relevant tests

and the results of the remote survey provide the same level of assurance obtained with attendance on board by a Surveyor.

2.2 Eligibility of the remote survey

2.2.1 *(1/1/2023)*

Eligibility of the remote survey is to be decided based on type and scope of the requested survey, in accordance with [3.2] and, if applicable, flag State Administration acceptance and possible instructions, when the classification survey is also related to a statutory item, and the Society is carrying out the statutory survey on behalf of the flag State Administration.

A remote survey is deemed eligible when it provides the same level of assurance, according to the requirements for equivalency, as if it was conducted with attendance on board by a Surveyor.

Remote surveys are generally to be carried out with internet connection allowing a live streaming visual examination, although, at the discretion of the Surveyor, a combination of remote survey methods (see [2.5]) may be used. For simple/limited verifications, other types of ICT may be accepted by the Surveyor.

2.3 Qualification and monitoring of Surveyors

2.3.1 Qualification *(1/1/2023)*

Surveyors engaged in remote surveys are to be qualified as per standard procedures for the type of ship and type of survey, i.e., in accordance with RINA training and qualification scheme.

Additional training is to be carried out, covering the ICT used for the remote survey, in relation to the applicable remote survey scope and methods, in order to fully qualify the Surveyor engaged in remote surveys.

The additional training required for qualification for remote surveys is to be in accordance with the Society's procedures and is to provide:

- knowledge of the operation of the Society's remote survey software, if applicable
- knowledge of the technical and procedural aspects related to remote surveys
- knowledge of the connectivity aspects related to remote surveys.

2.3.2 Monitoring *(1/1/2023)*

The monitoring of a Surveyor qualified for remote surveys is to be carried out in accordance with RINA standard procedure.

2.3.3 Surveyor's Record *(1/1/2023)*

Records of Surveyor's training and qualification for remote surveys are to be maintained and updated as per RINA standard procedures

Note 1: Society's personnel engaged in remote classification activities not requiring a survey (refer to [1.2]) are to be trained and qualified according to RINA's standard procedures.

2.3.4 On board personnel/Crew *(1/1/2023)*

Training and qualification of onboard personnel/Crew are regulated by the STCW Convention and is a prerogative of the flag State Administration.

The ship's flag State Administration may require that the Safety Management System of the ship is updated by the Company to include provisions for specific training of the crew engaged in remote surveys.

2.4 Planning of the remote survey

2.4.1 *(1/1/2023)*

Planning of the remote survey is required to ensure that the remote survey is carried out in accordance with the applicable requirements. The content of the planning is to be based on the scope of the remote survey.

To ensure that the Surveyor can properly plan the remote survey and communicate with personnel/crew, so that the survey is carried out according to the applicable rules, adequate means are to be available enabling the Surveyor and allowing the Society to:

- properly interact with personnel/crew involved in the remote survey, before and during the survey process
- agree on ICT means to be used
- verify that personnel/crew involved in the remote survey are suitably skilled to use the electronic devices and/or software used by the Society to perform the remote survey
- acquire as deemed necessary information on identity and ranking of personnel/crew involved in the remote survey
- provide the survey item/scope to the personnel/crew involved in facilitating the remote surveys, including the tests that will be performed
- communicate, during the remote survey, additional actions depending on the evidence to be collected.

One or more of the following means is to be provided for planning the remote survey:

- live-streaming video and audio connection
- exchange of data / electronic documents
- other means acceptable to the Society

The Owner is to provide the necessary facilities for the safe execution of the survey.

2.5 Performance of the remote survey

2.5.1 *(1/1/2023)*

To ensure that the Surveyor can properly perform the remote survey according to the applicable rules, the available evidence is to allow the attending Surveyor to:

- examine and assess a survey item and/or a group of items and/or supporting documents
- verify and assess applicable tests and/or services.

The evidence provided to the Surveyor is subject to the technical evaluation and final acceptance by the Surveyor with respect to the completeness and accuracy, necessary to perform the requested survey according to the applicable requirements.

One or more of the following evidence is to be provided for performing the remote survey:

- live-streaming video and audio
- recorded videos provided by the Owner's representative
- photos provided by the Owner's representative
- other data and/or supporting documents acceptable to the Society.

2.6 Assessment of the remote survey

2.6.1 *(1/1/2023)*

The Surveyor is to evaluate all evidence received and accept them before crediting the remote survey.

The means used for the remote survey are to allow the Surveyor to collect the necessary evidence that will be examined according to the Surveyor's professional judgement in order to satisfactorily complete and credit the relevant survey items.

In case the Surveyor, according to their professional judgement, deems that the remote survey does not provide the same level of assurance as a survey with attendance on board by a Surveyor, the Surveyor may decide not to credit the relevant survey items.

3 Scope and procedures

3.1 General

3.1.1 *(1/1/2023)*

A remote survey will be only appropriate provided it reaches the same level of assurance as, and is equivalent to, a survey attended on board by a Surveyor.

3.2 Scope - Eligible survey items

3.2.1 *(1/1/2023)*

A remote survey may be proposed as an alternative to a survey attended on board by a Surveyor for the surveys listed in Tab 1.

When the classification survey is also related to a statutory item, and the Society is carrying out the statutory survey on behalf of the flag State Administration, then the flag State Administration acceptance is required, and possible additional requirements are to be complied with.

The Surveyor may require to confirm the results of the remote survey, by a survey attended on board by a Surveyor, to credit the relevant survey items, in case the remote survey is not carried out to the Surveyor's satisfaction or it is required by the Society.

Table 1 : Eligible remote survey items *(1/1/2023)*

No.	Surveys and related items eligible to remote survey	Live streaming required (See Notes)
1	Postponement, issuance, deletion of Condition of Class	X (1)
2	Postponement of Class surveys	X (1)
3	Items of Continuous Survey for Machinery (ref to Sec 2, [4.3]) or Planned Maintenance Scheme (PMS) (ref to Sec 2, [4.4] and Pt F, Ch 12, Sec 1)	X (1)
4	Occasional survey for change of ship's name	X (1)
5	Occasional survey for loss of anchor	X (1)
6	Occasional survey for minor machinery or equipment damage	X (1)
7	Occasional survey for minor hull damage	X (1)
8	Occasional survey for minor deficiencies/defects not subject to a Condition of Class	X (1)
9	In-water bottom survey	X
10	Specified items of a class periodical survey (excluding additional specific items of initial or renewal surveys), including completion of remaining items of a part held class periodical survey	X (1)(2)
11	Non-propelled / un-manned barges/pontoon – annual surveys when no survey of hull compartments is due	X
12	Minor retrofit / installation/upgrade of equipment	X (1)
13	Documentary or data based initial / periodical / renewal / occasional verifications and surveys	

Notes:

(1) "(1)" means that live streaming may not be required for minor survey scope or that a combination remote survey method, as listed in [2.5], may be used at the sole discretion of the Society.

(2) "(2)" means that pure documentary verifications are eligible in accordance with item 13.

(3) Live streaming may be required for surveys not marked X in this Table, depending on the survey scope at the sole discretion of the Society.

(4) "Minor" in the items 6, 7, 8 and 12 means that the item can be surveyed remotely according to requirements for equivalency given in [2]

3.3 Procedures

3.3.1 Eligibility *(1/1/2023)*

Refer to [2.2].

3.3.2 Digital information quality, completeness, and accuracy *(1/1/2023)*

Final appraisal of the quality of digital information is at the discretion of the Surveyor, who is to be satisfied with the content and the quality of digital information collected, and the survey carried out, allowing the Surveyor to confirm its completion.

The Owner is responsible for the completeness and accuracy of digital information provided. The digital information submitted by the Owner to the Surveyor is to reflect the real situation of the surveyed item. The date and time, when a photo or video was taken are to be made available to the Surveyor or identifiable from its metadata.

The Society is to collect and store digital information as evidence of the survey. It is not necessary to store all of digital information received; the exact digital information stored is to support the survey decision and is to be decided by the Surveyor crediting the survey.

The remote survey is carried out under the supervision and upon instructions of the Surveyor, who is in charge of crediting the remote surveys. A Surveyor attendance on board may be required to complete the survey, upon the Surveyor's request and at his discretion.

3.3.3 Requirements for a remote survey when live streaming is not used *(1/1/2023)*

When live streaming is not used, communication and digital information collection are to be performed through an ICT channels (such as emails, data streams and clouds), which is to be accepted by the Society prior to the survey.

The Owner's representative is to confirm the identity of the ship at the commencement of the survey.

3.3.4 Requirements for a remote survey when live streaming is used *(1/1/2023)*

The Owner's is to ensure that:

- the Owner's representative is attending onboard and has access to the areas intended to be surveyed
- the Owner's representative has at his disposal a 2-ways visual and audible communication means complying with the requirements in [4]
- ICT solution is available on the communication means and meets the requirement described in [4]

In the case these requirements cannot be fulfilled, the remote survey may be rejected. The Surveyor is to verify the identity of the ship at the commencement of the survey by live streaming.

3.4 Hardware and ICT solution

3.4.1 General *(1/1/2023)*

Refer to [4.2].

3.5 Requirements for Connectivity

3.5.1 General *(1/1/2023)*

The Owner's representative is to ensure that internet connectivity tests are carried out before the survey and that proper connectivity is available and maintained during the survey.

When remote survey by live streaming is being undertaken, a connection that enables live streaming between the Surveyor and the Owner's representative attending on board is required. The quality of the live streaming connection (audio and video) is to ensure proper communication and to allow the Surveyor to carry out the survey remotely, to the Surveyor's satisfaction. In the case where a live streaming connection with the Surveyor is not possible or is not continuous at the place of the survey (e.g., Engine Room), partly online sequences (where the Owner is able to capture pictures and videos offline of those items not covered by live streaming) may be accepted by the Surveyor.

4 Information and Communication Technology (ICT)

4.1 General

4.1.1 *(1/1/2023)*

This Article outlines the minimum requirements for the use of ICT that can capture images, record video and/or live stream video or other data from a ship as considered acceptable to the Society.

4.2 Hardware

4.2.1 *(1/1/2023)*

The Owner is responsible for ensuring that all hardware installations on board used for the remote survey are to comply with the applicable requirements relevant for use and location on board, including hazardous areas. The ICT is to typically consist of:

- A host computer device, to receive the streaming of images/data/video. This is usually a laptop or desktop computer compatible with the software application used for the remote survey
- On board standalone device which may include digital cameras capable of capturing videos/photos/data
- On board smart device compatible with the applicable software/technology
- Communication accessories like headphones and microphone for the noisy environment as applicable and as deemed necessary

Note 1: The smart device may be a smartphone, tablet, computer, wearable device, smart glass, digital camera, or any other device which can be connected to the network and capable of transmitting the necessary data/images to shore.

The communication equipment used for the live streaming is to have the following minimum functionality:

- both ends shall simultaneously see the same image/videos in near real-time (i.e., live streaming)
- two-way direct voice communication
- possibility to take screenshots

When using a portable device on board for live streaming, the movement of the handheld device may affect the stability of the video and the image, leading to lower quality outputs. When necessary, a suitable anti-shake device is to be used to provide proper stability.

Note 2:

1) The host computer screen is to be able to present an image quality that is sufficient to enable a survey decision to be made

2) Portable equipment on board shall be equipped with a power capacity suitable for the intended scope and time of the survey

4.3 Internet Connectivity (coverage and speed)

4.3.1 *(1/1/2023)*

For internet connectivity requirements on board, refer to [3.5].

The onboard smart devices are to have the capability of transmitting the images/video/data over a Cellular, Wi-Fi or Satellite Connection to the remote Surveyor.

When live streaming communication is applied, the internet connection is to have sufficient and stable bandwidth capacity to ensure quality (such as resolution and frame rate) of the direct colour image/video and voice communication to the remote survey location to the satisfaction of the Surveyor.

4.4 Software and data security

4.4.1 *(1/1/2023)*

The software used for the remote survey is to be acceptable to the Society. The overall function and ability of the software used to ensure the security of data is to be evaluated prior to use as per the below requirements.

The Surveyor is to normally control the live video call, providing instructions to the on-site personnel/crew and supervising survey activities for capturing relevant information. The onboard device is to have the capability of transmitting the data over a Cellular, Wi-Fi, or Satellite Connection to the Surveyor.

The software used to perform the remote survey may also be provided with technologies that support the Surveyor in the process of making a decision, such as:

- Artificial Intelligence (AI) for the recognition and the classification of defects
- Internet of things (IoT) for collecting parameters and evaluating acceptability/working condition of machinery and equipment
- Data driven verification or other means considered acceptable by the Society.

The above software and technologies are to be evaluated and accepted by the Society in each case.

When considering the use of software/applications and other technologies, data protection is to be considered in accordance with applicable requirements of the Society before the remote survey is commenced. The software/application used to perform the remote survey is to be compatible with the technical requirements detailed in this paragraph; in addition, the software used is to comply with the Society's applicable requirements for:

- cybersecurity
- data protection and confidentiality for the transmitted data

When not provided by the Society itself, the audio/video software or application used to perform the remote survey is to be accepted by the Society.

During the survey preparation, it is the Owner's responsibility to ensure that their data security policies are implemented as per the Company's Safety Management System.

Note 1: The Company's SMS may take into account IMO resolution MSC.428(98), MSC-FAL.1/Circ.3 and IACS Rec.166.

5 Recording of evidence and reporting of survey

5.1 Recording of Evidence

5.1.1 Required evidence (refer to [2.5]) *(1/1/2023)*

In principle, live streaming video and audio are to be applied to remote surveys as a primary means (refer to Tab 1).

Additionally, and/or alternatively, one or more of the following evidence may be submitted or verified as requested by the Surveyor during remote survey so that the Surveyor is able to verify conditions of survey items:

- Recorded video and audio
- Photos
- Master's/chief engineer's statement
- Ship's logbook
- Owner's confirmation

a) **Live streaming video and audio**

Live streaming video and audio using ICT is to be in accordance with the requirements in [4].

b) **Recorded videos/photos**

For the recorded videos/photos, the following information is to be available:

- confirmation that they were actually taken on the ship by the Owner's representative
- date and time when they were taken
- identity of the personnel/crew responsible for taking evidence

c) **Master's/chief engineer's statement**

Recorded videos/photos provided by the Owner's representative may be supplemented with a statement signed by the master and/or the chief engineer confirming the condition of the items shown in the evidence. The final evaluation of the remote survey by the Surveyor is to be based on all of the provided evidence, and it does not delegate the responsibility to the master/chief engineer's statement only.

d) **Ship's logbook**

The Master is to make entries into ship's logbook on the following occasions and submit copies of the relevant pages when requested by the Surveyor:

- when a remote survey is carried out by the Surveyor
- when videos/photos are taken and submitted to the Surveyor with the master's/chief engineer's statement and additional documents as applicable.

e) **Owner's confirmation**

The Owner's representative or the master is to confirm the correctness and completeness of the provided information and evidence (if any) relevant to the condition of the items requested to be surveyed. This confirmation may be included in the survey application.

5.1.2 Retaining/filing evidence *(1/1/2023)*

The evidence submitted by the Owner's representative or master is to be retained/filed in accordance with the Society's procedures which are to include:

- type of evidence to be retained/filed
- duration/location to be retained/filed

It is not required for the Society to record and save live streaming video and audio as evidence unless the Surveyor considers it necessary.

5.1.3 Other supporting documents *(1/1/2023)*

The Surveyor may request the Owner's representative or master to submit supplementary documents such as ship's maintenance reports and record for the operation of machinery, and equipment and service reports issued by manufacturers, service suppliers or service providers.

While the Surveyor is to verify that the documents are duly prepared and issued to the ship, they may not be required to be retained/filed by the Society as evidence.

5.2 Reporting of remote survey

5.2.1 *(1/1/2023)*

The report of a remote survey is to be issued in accordance with the Society's procedure. The survey report is to also include the following additional information:

- indication that the survey was carried out remotely
- description of the means used during the remote survey
- indication of the provided evidence
- confirmation of the flag State Administration's authorization, when applicable.

SECTION 3 ANNUAL SURVEY

1 General

1.1

1.1.1 The requirements of this Section apply to annual surveys of all ships. The specific requirements for annual surveys related to service notations and additional class notations assigned to ships are addressed in Chapter 4 and Chapter 5, respectively.

1.1.2 At the time of annual surveys, the ship is to be generally examined. The survey is to include a visual inspection of the hull, equipment and machinery of the ship and some tests thereof, so far as necessary and practicable in order to verify that the ship is in a satisfactory and efficient general condition and is properly maintained.

1.1.3 Owners are reminded that, in compliance with the requirements in Ch 2, Sec 2, [11.4], any modification to the ship's hull, equipment and machinery affecting its classification is to be made known to the Society.

2 Hull

2.1 Scope

2.1.1 *(1/7/2006)*

The survey is to consist of an examination for the purpose of ensuring, as far as practicable, that the hull, hatch covers, hatch coamings, closing appliances, equipment and related piping are maintained in a satisfactory condition.

2.2 Hull and hull equipment

2.2.1 *(1/1/2023)*

The survey is to include a general external examination and testing, where appropriate, verifying the efficient condition of the following items, as applicable:

- outer shell plating above the waterline, relevant shell doors and accessible parts of the rudder(s)
- plating of freeboard deck and exposed decks, superstructures, with their openings and means of closure
- openings on exposed decks, with their coamings and their means of closure and securing arrangements (for cargo hatchways see [2.3])
- sidescuttles and deadlights, garbage chutes and other openings with their means of closure
- bulwarks, guard rails, freeing ports, gangways and lifelines, ladders
- scuppers and sanitary discharges, valves on discharge lines and their controls
- the means provided to minimise water ingress through the spurling pipes and chain lockers
- the arrangements for closing openings in the shell plating below the freeboard deck
- ventilators, air pipes, overflow pipes and gas vent pipes, with their means of closure and flame screens, where required. In particular:
  - examination of the weld connection between air pipes and deck plating
  - examination of flame screens on vents to all bunker tanks
  - examination of ventilators, including closing devices, if any.
- external examination of all air pipe heads installed on exposed decks including all automatic air pipe heads installed on exposed decks (see Note 2). This requirement is not applicable to passenger ships
- the special requirements for ships permitted to sail with type "A" or type "B-minus" freeboards
- fittings and appliances for timber deck cargoes, where applicable
- freeboard marks on the ship's sides
- deck equipment such as lifeboat davit foundations, bollards, fairleads, hawse pipes, etc., masts and associated rigging, including lightning conductors
- equipment of chain cables for anchors, windlass, mooring lines and mooring winches, where required
- confirmation that the towing and mooring equipment is properly marked with any restriction associated with its safe operation (for ships built after 1/1/2007)
- deck fittings, their pedestals, if any, and the hull structures associated with towing and mooring
- watertight bulkheads, their watertight doors and associated local and remote controls, and their watertight penetrations
- main and auxiliary steering arrangements, including their associated equipment, ~~and~~ control and alarm systems, and manoeuvring gear
- accessible cargo holds, in particular in areas likely to be damaged by cargo handling
- confirmation that the drainage from enclosed cargo spaces situated on the freeboard deck is satisfactory
- engine room and other dry spaces
- where fitted, helicopter deck and its supporting structure, safety net and arrangements for the prevention of sliding

2.6 Additional requirements for single hold cargo ships (see Note 1 to [1.1.1] of Ch 4, Sec 8)

2.6.1 *(1/7/2020)*

For ships complying with the requirements of SOLAS II-1/25 for hold water level detectors, the annual survey is to include an examination and a test, at random, of the water ingress detection system and of their alarms.

2.7 Watertight Cable Transits

2.7.1 *(1/7/2021)*

The Register (see Sec 1, [1.10.3] f)) is to be reviewed to confirm it is being maintained and as far as practicable the transits are to be examined to confirm their satisfactory condition.

2.7.2 *(1/7/2021)*

Where there are records entered since the last annual survey of any disruption to the cable transits or installation of new cable transits, the satisfactory condition of those transits, in accordance with the manufacturer's requirements and in accordance with the requirements of type approval, is to be confirmed by review of records and, if deemed necessary, by examination.

It is to be confirmed that, where specified, appropriate specialized tools have been used.

The results are to be recorded in the Register against the specific cable transit.

3 Machinery and systems

3.1 General machinery installations

3.1.1 *(1/1/2023)*

The survey of general machinery installations is to cover the following items:

- general examination of machinery and boiler spaces with particular attention to the fire and explosion hazards
- general examination of the machinery, ~~—~~steam, hydraulic, pneumatic, ballasting arrangements, ventilation and other systems and their associated fittings, for confirmation of their proper maintenance
- testing of the means of communication and order transmission between the navigating bridge and the machinery control positions and other control stations
- confirmation that the rudder angle indicator on the bridge is in working order
- examination, as far as practicable, of the bilge pumping systems and bilge wells, including operation of the pumps, remote reach rods and level alarms, where fitted
- visual examination of the condition of any expansion joints in sea water systems
- external examination of pressure vessels other than boilers and their appurtenances, including safety devices, foundations, controls, relieving gear, high pressure piping, insulation and gauges
- visual examination of mechanical components used for cooling and maintaining an ambient temperature lower than 45°C (see Pt C, Ch 2, Sec 2, [1.2.2])
- confirmation that no new materials containing asbestos have been installed on board~~.~~
- confirmation that the machinery, boilers and other pressure vessels, associated piping systems and fittings are installed and protected so as to reduce to a minimum any danger to persons on board, due regard being given to moving parts, hot surfaces and other hazards
- confirmation that the engineer's alarm is clearly audible in the engineers' accommodation
- confirmation that the normal operation of the propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative
- confirmation that means are provided so that the machinery can be brought into operation from the dead ship condition without external aid
- examination, where applicable, of the alternative design and arrangements for machinery or electrical installations, low-flashpoint fuel storage and distribution systems, in accordance with the test, inspection and maintenance requirements, if any, specified in the approved documentation.

3.1.2 *(1/1/2007)*

When the ship is equipped with a refrigerating plant (whether or not covered by an additional class notation), the annual survey is to include the external examination of:

- pressure vessels of the installation to the same extent as indicated in [3.1.1]
- refrigerant piping, as far as practicable
- for refrigerating machinery spaces using ammonia as refrigerant:
  - ventilation system including functional test
  - bilge system including functional test
  - electrical equipment, confirming its proper maintenance
  - gas detection system
  - breathing apparatus and protective clothing.

3.1.3 When the ship is equipped with thruster installations, the annual survey is to include:

- an external examination of the machinery installation
- an operating test of the complete installation.

3.2 Boilers

3.2.1 For main and auxiliary boilers, the annual survey consists of an external examination of boilers and their appurtenances, including safety devices, foundations, controls, relieving, high pressure and steam escape piping, insulation and gauges.

SECTION 9 ~~GAS~~LNG FUELLED OR CNG FUELLED SHIPS

1 Ships other than liquefied gas carriers

1.1 Application

1.1.1 *(1/1/2018)*

These requirements have to apply to ships, other than those covered by Pt E, Ch 9, Sec 16, which utilize gas or other low flash point fuels as a fuel for propulsion prime mover/auxiliary power generation arrangements and associated systems.

These requirements are in addition to the requirements of Sec 3, Sec 4 and Sec 5.

These survey requirements do not cover fire protection, fire-fighting installation, and personnel protection equipment.

1.2 Annual Survey

1.2.1 Scope *(1/1/2018)*

The following is to be carried out during the survey of the Fuel Storage, Fuel Bunkering System, and Fuel Supply System:

a) Logbooks/Records

The logbooks and operating records are to be examined with regard to correct functioning of the gas detection systems, fuel supply/gas systems, etc. The hours per day of the re-liquefaction plant, gas combustion unit, as applicable, the boil-off rate, and nitrogen consumption (for membrane containment systems) are to be considered together with gas detection records.

b) Operating and Maintenance Instruction Manuals

The manufacturer/builder instructions and manuals covering the operations, safety and maintenance requirements and occupational health hazards relevant to fuel storage, fuel bunkering, and fuel supply and associated systems for the use of the fuel, are to be confirmed as being aboard the vessel.

c) Control, Monitoring and Safety Systems

1) Gas detection and other leakage detection equipment in compartments containing fuel storage, fuel bunkering, and fuel supply equipment or components or associated systems, including indicators and alarms, is to be confirmed in satisfactory operating condition. Recalibration of the gas detection systems should be verified in accordance with the manufacturers' recommendations.

2) Verification of the satisfactory operation of the control, monitoring and automatic shut-down systems as far as practicable of the fuel supply and bunkering systems.

3) Operational test, as far as practicable, of the shutdown of ESD protected machinery spaces.

d) Fuel Handling Piping, Machinery and Equipment

Piping, hoses, emergency shut-down valves, remote operating valves, relief valves, machinery and equipment for fuel storage, fuel bunkering, and fuel supply such as venting, compressing, refrigerating, liquefying, heating, cooling or otherwise handling the fuel is to be examined, as far as practicable. Means for inerting is to be examined. Stopping of pumps and compressors upon emergency shut-down of the system is to be confirmed as far as practicable.

e) Ventilating System

Examination of the ventilation system, including portable ventilating equipment where fitted, is to be made for spaces containing fuel storage, fuel bunkering, and fuel supply units or components or associated systems, including air locks, pump rooms, compressor rooms, fuel preparation rooms, fuel valve rooms, control rooms and spaces containing gas burning equipment. Where alarms, such as differential pressure and loss of pressure alarms, are fitted, these should be operationally tested as far as practicable.

f) Drip Trays

Portable and fixed drip trays and insulation for the protection of the ship's structure in the event of leakage are to be examined.

g) Hazardous Areas

Electrical equipment and bulkhead/deck penetrations including access openings in hazardous areas are to be examined for continued suitability for their intended service and installation area.

h) Electrical Bonding

Electrical bonding arrangements in hazardous areas, including bonding straps where fitted, are to be examined.

1.2.2 Fuel Storage, Bunkering and Supply Systems *(1/1/2018)*

The following are to be examined, so far as applicable. Insulation need not be removed, but any deterioration or evidence of dampness is to be investigated:

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SECTION 4 DOUBLE HULL OIL TANKERS

1 General

1.1 Application

1.1.1 *(1/7/2011)*

The requirements of this Section apply to all self-propelled ships which have been assigned one of the following service notations .

- **oil tanker ESP - double hull**
- **oil tanker ESP CSR**.

Self-propelled ships which have been assigned the service notation **oil tanker-double hull**, without integral cargo tanks and having independent cargo tanks within the hull, are to be surveyed, as far as applicable, according to the provisions given for ships having the service notation **liquefied gas carrier**, as far as hull surveys are concerned, as laid down in Sec 6.

1.1.2 *(1/1/2003)*

The requirements for hull surveys apply to the surveys of the hull structure and piping systems in way of cargo tanks, pump rooms, cofferdams, pipe tunnels and void spaces within the cargo area and all salt water ballast tanks. They are additional to the requirements applicable to the remainder of the ship, given in Chapter 3 according to the relevant surveys.

1.1.3 *(1/1/2003)*

The requirements contain the minimum extent of examination, thickness measurements and tank testing. When substantial corrosion, as defined in Ch 2, Sec 2, [2.2.9], and/or structural defects are found, the survey is to be extended and is to include additional close-up surveys when necessary.

1.1.4 *(1/1/2019)*

When, in any survey, thickness measurements are required:

- the procedure detailed in Ch 2, Sec 2, [2.3] is to be applied
- the thickness measurement firm is to be part of the survey planning meeting held prior to commencing the survey.

1.1.5 *(1/1/2003)*

For machinery surveys, the requirements given in Sec 3 apply.

1.2 Documentation on board

1.2.1 *(1/7/2016)*

The Owner is to supply and maintain documentation on board as specified in [1.2.2] and [1.2.3], which is to be readily available for examination by the Surveyor. The documentation is to be kept on board for the lifetime of the ship.

For tankers and bulk carriers subject to SOLAS Chapter II-1 Part A-1 Regulation 3-10, the Owner is to arrange the updating of the Ship Construction File (SCF) throughout the ship's life whenever a modification of the documentation included in the SCF has taken place. Documented procedures for updating the SCF are to be included within the Safety Management System.

1.2.2 *(1/1/2003)*

A survey report file is to be a part of the documentation on board consisting of:

- reports of structural surveys
- hull condition evaluation report (summarising the results of class renewal surveys)
- thickness measurement reports.

The survey report file is also to be available in the Owner's management office.

1.2.3 *(1/7/2016)*

The following additional supporting documentation is to be available on board:

- survey program, as required in [4.1], until such time as the class renewal survey or the intermediate survey, as applicable, has been completed
- main structural plans of cargo and ballast tanks (for CSR ships these plans are to include for each structural element both the as-built and renewal thickness. Any thickness for voluntary addition is also to be clearly indicated on the plans. The Midship Section plan to be supplied on board the ship is to include the minimum allowable hull girder sectional properties for the tank transverse section in all cargo tanks)
- previous repair history
- cargo and ballast history
- extent of use of inert gas system and tank cleaning procedures
- ship's personnel reports on:
  - structural deterioration/defects in general
  - leakage in bulkheads and piping systems
  - condition of coatings or corrosion prevention systems, if any
- any other information that may help to identify critical structural areas and/or suspect areas requiring inspection.

For double hull tankers subject to SOLAS Chapter II-1 Part A-1 Regulation 3-10, the Ship Construction File (SCF), limited to the items to be retained on board, is to be available on board.

4 Class renewal survey - Hull items

4.1 Survey program and preparation for hull survey

4.1.1 *(1/1/2008)*

The Owner, in co-operation with the Society, is to work out a specific survey program prior to the commencement of any part of:

- the class renewal survey
- the intermediate survey for double hull oil tankers over 10 years of age.

Prior to the development of the survey program, the Survey Planning Questionnaire is to be completed by the Owner based on the information set out in [4.9], and forwarded to the Society.

The survey program is to be in a written format, based on the information in [4.8]. The survey is not to commence until the survey program has been agreed. The survey program at intermediate surveys may consist of the survey program at the previous class renewal survey supplemented by the condition evaluation report of that class renewal survey and later relevant survey reports.

The survey program is to be worked out taking into account any amendments to the survey requirements implemented after the last class renewal survey carried out.

4.1.2 *(1/1/2019)*

In developing the survey program, the following documentation is to be collected and consulted with a view to selecting tanks, areas and structural elements to be examined:

a) survey status and basic ship information;

b) documentation on board, as described in [1.2.2] and [1.2.3]

c) main structural plans of cargo and ballast tanks (scantling drawings), including information regarding use of high tensile steels (HTS);

d) Executive Hull Summary (or Conditional Evaluation Report);

e) relevant previous damage and repair history;

f) relevant previous survey and inspection reports from both the recognised organisation and the Owner;

g) cargo and ballast history for the last 3 years, including carriage of cargo under heated conditions;.

h) details of the inert gas plant and tank cleaning procedures;

i) information and other relevant data regarding conversion or modification of the ship's cargo and ballast tanks since the time of construction;

j) description and history of the coating and corrosion protection system (including previous class notations), if any;

k) inspections by the Owner's personnel during the last 3 years with reference to structural deterioration in general, leakages in tank boundaries and piping, and condition of the coating and corrosion protection system, if any (guidance for reporting is shown in Tab 15);

l) information regarding the relevant maintenance level during operation including Port State Control reports of inspection containing hull related deficiencies, Safety Management System non-conformities relating to hull maintenance, including the associated corrective action(s); and

m) any other information that will help identify suspect areas and critical structural areas.

4.1.3 *(1/1/2019)*

The submitted survey program is to take account of and comply with at least the requirements for close-up surveys, thickness measurements and tank testing given in Tab 2, Tab 3 and [4.5], respectively. In addition, the survey program is to include at least:

a) basic ship information and particulars;

b) main structural plans (scantling drawings), including information regarding use of high tensile steels (HTS);

c) plan of tanks

d) list of tanks with information on use, corrosion prevention and condition of coating;

e) conditions for survey (e.g. information regarding tank cleaning, gas freeing, ventilation, lighting etc);

f) provisions and methods for access to structures;

g) equipment for surveys;

h) nomination of tanks and areas for close-up survey (see [4.3]);

i) nomination of sections for thickness measurement (see [4.4]);

j) nomination of tanks for tank testing (see [4.5]);

k) identification of the thickness measurement firm;

l) damage experience related to the ship in question;

m) critical structural areas and suspect areas, where relevant.

4.1.4 *(1/1/2003)*

The survey program is also to include the maximum acceptable structural corrosion diminution levels applicable to the ship. The Society will advise the Owner of this information.

4.1.5 *(1/1/2003)*

In addition, the survey program is to include proposals on how to conduct surveys and tests in a safe and practical way, including the means of providing access to structures for close-up survey, thickness measurements and tank testing. All other provisions described in Ch 2, Sec 2, [2.3], Ch 2, Sec 2, [2.5], Ch 2, Sec 2, [2.7], Ch 2, Sec 2, [2.8] and Ch 2, Sec 2, [2.10] regarding procedures for thickness measurements, conditions for survey, access to structures, equipment for survey and survey at sea or at anchorage, respectively, are also to be complied with.

4.1.6 Survey Planning Meeting *(1/1/2019)*

Proper preparation and close co-operation between the attending Surveyor(s) and the Owner's representatives on board prior to and during the survey are an essential part in the safe and efficient conduct of the survey. During the survey on board safety meetings are to be held regularly.

4.4 Thickness measurements

4.4.1 *(1/1/2003)*

The minimum requirements for thickness measurements at class renewal survey are given in Tab 3.

4.4.2 *(1/7/2012)*

Provisions for extended measurements for areas with substantial corrosion are given in Tab 4 to Tab 8 and as may be additionally specified in the survey program as required in [4.1].

These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to be subjected to thickness measurements.

For ships built under the Common Structural Rules, the identified substantial corrosion areas are required to be examined and additional thickness measurements are to be carried out at annual and intermediate surveys.

Table 2 : Requirements for close-up survey at class renewal survey of double hull oil tankers *(1/1/2019)*

Age of ship (in years at time of class renewal survey)			
age ≤ 5	5 < age ≤ 10	10 < age ≤ 15	age > 15
One web frame (1) (see Note 1), in a ballast tank (see Note 2)	All web frames (1) (see Note 1), in a ballast tank (see Note 2) The knuckle area and the upper part (approximately 5 metres) of one web frame in each remaining ballast tank (6) (see Note 1)	All web frames (1) (see Note 1), in all ballast tanks	As for class renewal survey for age from 10 to 15 years Additional transverse areas as deemed necessary by the Society
One deck transverse, in a cargo oil tank (2) (see Note 1)	One deck transverse, in two cargo oil tanks (2) (see Note 1)	All web frames (7 (see Note 1)), including deck transverse and cross ties, if fitted. in a cargo oil tank One web frame (7) (see Note 1), including deck transverse and cross ties, if fitted, in each remaining cargo oil tank	

Note 1: (1), (2), (3), (4), (5), (6) and (7) are areas to be subjected to close-up surveys and thickness measurements according to Tab 3 (see Fig 1 and Fig 2)

(1) : "Web frame" in a ballast tank means vertical web in side tank, hopper web in hopper tank, floor in double bottom tank and deck transverse in double deck tank (where fitted), including adjacent structural members. In fore and aft peak tanks, "web frame" means a complete transverse web frame ring including adjacent structural members

(2) : Deck transverse, including adjacent deck structural members (or external structure on deck in way of the tank, where applicable)

(3) : Transverse bulkhead complete in cargo tanks, including girder system, adjacent structural members (such as longitudinal bulkheads) and internal structure of lower and upper stools, where fitted

(4) : Transverse bulkhead complete in ballast tanks, including girder system and adjacent structural members, such as longitudinal bulkheads, girders in double bottom tanks, inner bottom plating, hopper side, connecting brackets

(5) : Transverse bulkhead lower part in cargo tank, including girder system, adjacent structural members (such as longitudinal bulkheads) and internal structure of lower stool, where fitted

(6) : The knuckle area and the upper part (approximately 5 metres), including adjacent structural members. Knuckle area is the area of the web frame around the connections of the slope hopper plating to the inner hull bulkhead and the inner bottom plating, up to 2 metres from the corners both on the bulkhead and the double bottom

(7) : Web frame in a cargo oil tank means deck transverse, longitudinal bulkhead structural elements and cross ties, where fitted, including adjacent structural members

Note 2: Ballast tank: apart from the fore and aft peak tanks, the term "ballast tank" has the following meaning:

- all ballast compartments (hopper tank, side tank and double-deck tank, if separate from double-bottom tank) located on one side, i.e. portside or starboard side, and additionally double-bottom tank on portside plus starboard side, when the longitudinal central girder is not watertight and, therefore, the double-bottom tank is a unique compartment from portside to starboard side; or
- all ballast compartments (double-bottom tank, hopper tank, side tank and double-deck tank) located on one side, i.e. portside or starboard side, when the longitudinal central girder is watertight and, therefore, the portside double-bottom tank separate from the starboard-side double-bottom tank.

Note 3: Where no centre cargo tanks are fitted (as in the case of centre longitudinal bulkhead), transverse bulkheads in wing tanks are to be surveyed.

Table 3 : Requirements for thickness measurements at class renewal survey of double hull oil tankers *(1/1/2023)*

Age of ship (in years at time of class renewal survey)			
age ≤ 5	5 < age ≤ 10	10 < age ≤ 15	age > 15
~~One section of deck plating for the full beam of the ship within the cargo area~~	Within the cargo area: • each deck plate • one transverse section **(1)**	Within the cargo area: • each deck plate • two transverse sections **(1) (2)** • all wind and water strakes	Within the cargo area: • each deck plate • three transverse sections **(1) (2)** • each bottom plate
	Selected wind and water strakes outside the cargo area	Selected wind and water strakes outside the cargo area	All wind and water strakes, full length
~~Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up Survey according to Tab 2~~	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up Survey according to Tab 2	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up Survey according to Tab 2	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up Survey according to Tab 2
Suspect areas	Suspect areas	Suspect areas	Suspect areas

(1) transverse sections are to be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements

(2) at least one section should be within 0,5L amidships

Table 4 : Requirements for extent of thickness measurements at those areas of substantial corrosion on double hull oil tankers within the cargo area length *(1/1/2003)*

BOTTOM, INNER BOTTOM AND HOPPER STRUCTURE		
Structural member	Extent of measurement	Pattern of measurement
Bottom, inner bottom and hopper structure plating	Minimum of three bays across double bottom tank, including aft bay Measurements around and under all suction bell mouths	5-point pattern for each panel between longitudinals and floors
Bottom, inner bottom and hopper structure longitudinals	Minimum of three longitudinals in each bay where bottom plating measured	Three measurements in line across flange and three measurements on vertical web
Bottom girders, including the watertight ones	At fore and aft watertight floors and in centre of tanks	Vertical line of single measurements on girder plating with one measurement between each panel stiffener, or a minimum of three measurements
Bottom floors, including the watertight ones	Three floors in bays where bottom plating measured, with measurements at both ends and middle	5-point pattern over two square metre area
Hopper structure web frame ring	Three floors in bays where bottom plating measured	5-point pattern over one square metre of plating. Single measurements on flange
Hopper structure transverse watertight bulkhead or swash bulkhead	• lower 1/3 of bulkhead	• 5-point pattern over one square metre of plating
	• upper 2/3 of bulkhead	• 5-point pattern over two square metre of plating
	• stiffeners (minimum of three)	• For web, 5-point pattern over span (two measurements across web at each end and one at centre of span). For flange, single measurements at each end and centre of span
Panel stiffening	Where applicable	Single measurements

SECTION 5 CHEMICAL TANKERS

1 General

1.1 Application

1.1.1 *(1/7/2011)*

The requirements of this Section apply to all self-propelled ships which have been assigned the service notation **chemical tanker ESP**.

Self-propelled ships which have been assigned the service notation c**hemical tanker**, without integral cargo tanks and having independent cargo tanks within the hull, are to be surveyed, as far as applicable, according to the provisions given for ships having the service notation **liquefied gas carrier**, as far as hull surveys are concerned, as laid down in Sec 6.

1.1.2 The requirements for hull surveys apply to the surveys of the hull structure and piping systems in way of cargo tanks, pump rooms, cofferdams, pipe tunnels and void spaces within the cargo area and all salt water ballast tanks. These requirements, however, do not apply to independent tanks on deck. They are additional to the requirements applicable to the remainder of the ship, given in Chapter 3 according to the relevant surveys.

1.1.3 The requirements contain the minimum extent of examination, thickness measurements and tank testing. When substantial corrosion, as defined in Ch 2, Sec 2, [2.2.9], and/or structural defects are found, the survey is to be extended and is to include additional close-up surveys when necessary.

1.1.4 *(1/1/2019)*

When, in any survey, thickness measurements are required :

- the procedure detailed in Ch 2, Sec 2, [2.3] is to be applied
- the thickness measurement firm is to be part of the survey planning meeting held prior to commencing the survey.

1.1.5 *(1/1/2019)*

When close-up surveys are required, consideration maybe given by the Surveyor to allow the use of Remote Inspection Techniques (RIT), according to the provisions of Ch 2, Sec 2, [2.3.3] and Ch 2, Sec 2, [2.6].

1.1.6 The requirements for machinery surveys apply to surveys of the machinery and equipment in the cargo area or dedicated to cargo service systems and are additional to those given in Chapter 3 for all ships.

1.2 Documentation on board

1.2.1 General *(1/1/2010)*

The Owner is to obtain, supply and maintain documentation on board as specified in [1.2.2] and [1.2.3], which is to be readily available for examination by the Surveyor. The documentation is to be kept on board for the lifetime of the ship.

1.2.2 Survey Report File

A survey report file is to be a part of the documentation on board consisting of:

- reports of structural surveys
- hull condition evaluation report (summarising the results of class renewal surveys)
- thickness measurement reports.

The survey report file is also to be available in the Owner's management office.

1.2.3 Supporting documents *(1/1/2010)*

The following additional supporting documentation is to be available on board:

- survey program, as required in [6.1], until such time as the class renewal survey or the intermediate survey, as applicable, has been completed
- main structural plans of cargo and ballast tanks
- previous repair history
- cargo and ballast history
- extent of use of inert gas system and tank cleaning procedures
- ship's personnel reports on:
  - structural deterioration/defects in general
  - leakage in bulkheads and piping systems
  - condition of coatings or corrosion prevention systems, if any
- any other information that may help to identify critical structural areas and/or suspect areas requiring inspection.

1.2.4 Prior to survey, the Surveyor examines the documentation on board and its contents, which are used as a basis for the survey.

1.3 Reporting and evaluation of surveys

1.3.1 The data and information on the structural condition of the ship collected during survey are evaluated for acceptability and structural integrity of the ship's cargo area.

1.3.2 *(1/7/2006)*

For ships subject to the requirements of this Section, the surveys of hull structure and piping systems are reported in conformance to the Survey Reporting Principles laid down in App 1.

1.3.3 A hull condition evaluation report (summarising the results of class renewal surveys) is issued by the Society to the Owner, who is to place it on board the ship for

5.1.3 The satisfactory condition of the cargo heating/cooling system is to be verified.

5.2 Inert gas system

5.2.1 For ships over 10 years old at the time of the intermediate survey due date, if an inert gas system such as that installed on board oil tankers is fitted, the requirements given in Sec 3, [5.2] for intermediate survey of oil tankers are to be complied with.

5.2.2 For ships over 10 years old at the time of the intermediate survey due date and fitted with another type of inert gas producing system, the main parts such as the inert gas generator, deck water seal or equivalent back flow arrangement, segregation devices, as fitted are to be overhauled for examination and alarms are to be tested.

Inert gas producer isolating valves, when fitted, are to be dismantled for examination.

6 Class renewal survey - Hull items

6.1 Survey program and preparation for hull survey

6.1.1 *(1/1/2010)*

The Owner, in co-operation with the Society, is to work out a specific survey program prior to the commencement of any part of:

- the class renewal survey
- the intermediate survey for chemical tanker over 10 years of age.

The survey program at intermediate surveys may consist of the survey program at the previous class renewal survey supplemented by the condition evaluation report of that class renewal survey and later relevant survey reports.

The survey program is to be worked out taking into account any amendments to the survey requirements implemented after the last class renewal survey carried out.

The survey program is to be in a written format based on the information in [6.8].

Prior to the development of the survey program, the Survey Planning Questionnaire is to be completed by the Owner based on the information set out in [6.9], and forwarded to the Society.

6.1.2 *(1/1/2019)*

In developing the survey program, the following documentation is to be collected and consulted with a view to selecting tanks, areas and structural elements to be examined:

a) survey status and basic ship information

b) information included in the documentation on board, as described in [1.2.2] and [1.2.3]

c) main structural plans of cargo and ballast tanks (scantling drawings), including information on use of high tensile steels (HTS) and stainless steels

d) Condition Evaluation Report or Executive Hull Summary

e) relevant previous damage and repair history

f) relevant previous survey and inspection reports from both the Society and the Owner

g) information on the use of ship tanks, typical cargoes and other relevant data

h) details of the inert gas plant and tank cleaning procedures

i) information and other relevant data regarding conversion or modification of the ship's cargo and ballast tanks since the time of construction

j) description and history of the coating and corrosion protection system (previous class notations), if any

k) inspections by the Owner's personnel during the last 3 years with reference to structural deterioration in general, leakages in tank boundaries and piping, and condition of the coating and corrosion protection system, if any (guidance for reporting is shown in Tab 1)

l) information regarding the relevant maintenance level during operation, including Port State Control reports of inspection containing hull related deficiencies, Safety Management System non-conformities relating to hull maintenance, including the associated corrective action(s); and

m) any other information that will help identify suspect areas and critical structural areas.

6.1.3 *(1/1/2019)*

The survey program is to take account of and comply, at least, with the requirements for close-up surveys, thickness measurements, tank testing and pipe testing given in Tab 3, Tab 4, [6.5] and [6.6.3], respectively. In addition, the survey program is to include at least:

a) basic ship information and particulars

b) main structural plans (scantling drawings), including information on the use of high tensile steels (HTS), clad steels and stainless steels

c) plan of tanks

d) list of tanks including information on their use, corrosion prevention and condition of coating

e) conditions for survey, with regard to tanks and spaces which are to be safe for access, i.e. cleaned, gas freed, ventilated and illuminated

f) provisions and methods for access to structures

g) equipment for surveys

h) nomination of tanks, spaces and areas for close-up surveys according to [6.3]

i) nomination of sections and areas for thickness measurements according to [6.4]

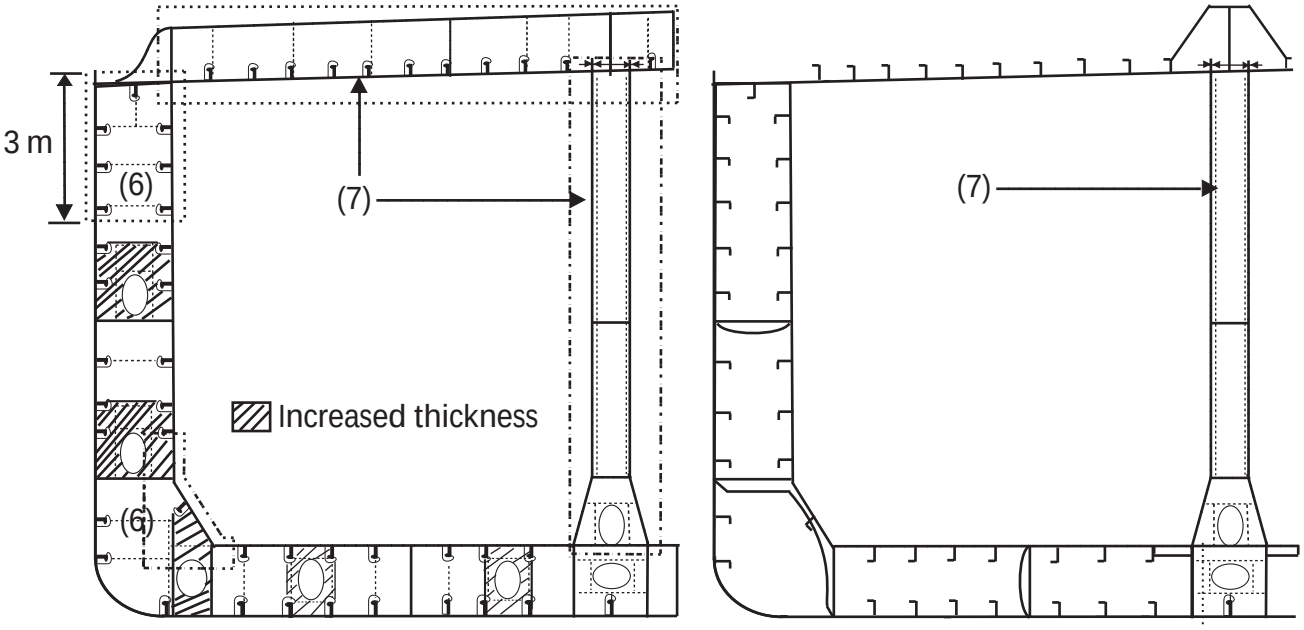
j) nomination of tanks for tank testing according to [6.5]; and the pipes that are to undergo pipe testing according to [6.6.3]

k) identification of the thickness measurement firm

l) damage experience related to the ship in question

m) critical structural areas and suspect areas, where relevant.

Figure 3 : Representative transverse section of chemical tanker. Areas 6 and 7 *(1/7/2013)*



6.4 Thickness measurements

6.4.1 The minimum requirements for thickness measurements at class renewal survey are given in Tab 4. Thickness measurement of stainless steel hull structure and piping may be waived by the Society, except for clad steel plating.

6.4.2 *(1/7/2006)*

Provisions for extended measurements for areas with substantial corrosion are given in Tab 5 to Tab 8 and as may be additionally specified in the survey program as required in [6.1].

These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to be subjected to thickness measurements.

6.4.3 *(1/7/2006)*

The Surveyor may further extend the thickness measurements as deemed necessary.

6.4.4 When pitting is found on bottom plating and its intensity is 20% or more, thickness measurements are to be extended in order to determine the actual plate thickness out of the pits and the depth of the pits. Where the wastage is in the substantial corrosion range or the average depth of pitting is 1/3 or more of the actual plate thickness, the pitted plate is to be considered as a substantially corroded area.

6.4.5 *(1/7/2006)*

For areas in tanks where hard protective coatings are found to be in good condition as defined in Ch 2, Sec 2, [2.2.13], the extent of thickness measurements according to Tab 4 may be specially considered.

6.4.6 *(1/7/2006)*

Transverse sections are to be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements.

6.4.7 *(1/7/2006)*

In cases where two or three sections are to be measured, at least one is to include a ballast tank within 0,5L amidships.

6.5 Tank testing

6.5.1 *(1/7/2016)*

The minimum requirements for ballast tank testing at Special Survey are given in [6.5.3] and Tab 9.

The minimum requirements for cargo tank testing at Special Survey are given in [6.5.4] and Tab 8.

Cargo tank testing carried out by the vessel's crew under the direction of the Master may be accepted by the surveyor provided the following conditions are complied with:

a) a tank testing procedure, specifying fill heights, tanks being filled and bulkheads being tested, has been submitted by the owner and reviewed by the Society prior to the testing being carried out;

b) there is no record of leakage, distortion or substantial corrosion that would affect the structural integrity of the tank;

c) the tank testing has been satisfactorily carried out within special survey window not more than 3 months prior to the date of the survey on which the overall or close up survey is completed;

d) the satisfactory results of the testing are recorded in the vessel's logbook;

e) the internal and external condition of the tanks and associated structure are found satisfactory by the surveyor at the time of the overall and close up survey.

6.5.2 The Surveyor may extend the tank testing as deemed necessary.

6.5.3 *(1/7/2006)*

Boundaries of ballast tanks are to be tested with a head of liquid to the top of air pipes.

Table 4 : Requirements for thickness measurements at class renewal survey of chemical tankers *(1/1/2023)*

Age of ship (in years at time of class renewal survey)			
age ≤ 5	5 < age ≤ 10	10 < age ≤ 15	age > 15
Suspect areas	Suspect areas	Suspect areas	Suspect areas
~~One section of deck plating for the full beam of the ship within the cargo area (in way of a ballast tank, if any, or a cargo tank used primarily for water ballast)~~	Within the cargo area: • each deck plate • one transverse section **(1)**	Within the cargo area: • each deck plate • two transverse sections **(1)** **(2)** • all wind and water strakes	Within the cargo area: • each deck plate • three transverse sections **(1)** **(2)** • each bottom plate
~~Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Tab 3~~	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Tab 3	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Tab 3	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Tab 3
	Selected wind and water strakes outside the cargo area	Selected wind and water strakes outside the cargo area	All wind and water strakes, full length

(1) Transverse sections are to be chosen where the largest reductions are likely to occur or as revealed by deck plating measurements.

(2) At least one section is to be within 0,5 L amidships and, where applicable, in way of a ballast tank.

Table 5 : Requirements for extent of thickness measurements at those areas of substantial corrosion Class renewal survey of chemical tankers within the cargo area length *(1/1/2010)*

BOTTOM, INNER BOTTOM AND HOPPER STRUCTURE		
Structural member	Extent of measurement	Pattern of measurement
Bottom, inner bottom and hopper structure plating	Minimum of three bays across tank, including aft bay Measurements around and under all suction bell mouths	5-point pattern for each panel between longitudinals and floors
Bottom, inner bottom and hopper structure longitudinals	Minimum of three longitudinals in each bay where bottom plating measured	Three measurements in line across the flange and three measurements on vertical web
Bottom girders, including watertight ones	At fore and aft watertight floors and in centre of tanks	Vertical line of single measurements on girder plating with one measurement between each panel stiffener, or a minimum of three measurements. Two measurements across face flat where fitted
Bottom floors, including watertight ones	Three floors in bays where bottom plating measured, with measurements at both ends and middle	5-point pattern over two square metre area
Hopper structure web frame ring	Three floors in bays where bottom plating measured	5-point pattern over one square metre of plating. Single measurements on flange
Hopper structure transverse watertight bulkhead or swash bulkhead	lower 1/3 of bulkhead	5-point pattern over one square metre of plating
	upper 2/3 of bulkhead	5-point pattern over two square metre of plating
	stiffeners (minimum of three)	For web, 5-point pattern over span (two measurements across web at each end and one at centre of span). For flange, single measurements at each end and centre of span
Panel stiffening	Where applicable	Single measurements

SECTION 7 RO-RO CARGO SHIPS, CAR CARRIER PASSENGER SHIPS, RO-RO PASSENGER SHIPS

1 General

1.1

1.1.1 *(1/7/2016)*

The requirements of this Section are applicable after construction to all self-propelled ships which have been assigned one of the following service notations:

- **ro-ro cargo ship**
- **car carrier**
- **passenger ship**
- **ro-ro passenger ship**.

1.1.2 These requirements are additional to those laid down in Chapter 3, according to the relevant surveys.

1.1.3 Periodical lightweight check

At periodical intervals not exceeding five years, a lightweight survey is to be carried out on all ships having the service notation **passenger ship** or **ro-ro passenger ship** to verify any changes in lightship displacement and longitudinal centre of gravity. The ship is to be re-inclined whenever, in comparison with the approved stability information, a deviation from the lightship displacement exceeding 2% or a deviation of the longitudinal centre of gravity exceeding 1% of L is found, or anticipated.

1.2 Application

1.2.1 General *(1/1/2012)*

The survey requirements in [2.1], [3.1] and [6.1] for annual and renewal survey are applicable to the survey of bow, inner, side shell and stern doors of ro-ro passenger ships and ro-ro cargo ships, to the extent appropriate to the arrangement and equipment of each ship.

1.2.2 Special consideration *(1/1/2012)*

Special consideration may be given in application of relevant requirements of this Section to commercial vessels owned or chartered by Governments, which are utilised in support of military operations or service.

1.3 Definitions

1.3.1 General *(1/1/2012)*

For the purpose of the survey requirements for shell and inner doors laid down in [2.1], [3.1] and [6.1] for annual and renewal survey for ro-ro cargo ships and ro-ro passenger ships, the following definitions are given.

1.3.2 Ro-ro ship *(1/1/2012)*

A ro-ro ship is a ship which utilises a loading ramp to enable wheeled vehicles to be rolled on and rolled off the ship.

1.3.3 Ro-ro passenger ship *(1/1/2012)*

A ro-ro passenger ship is a passenger ship with ro-ro spaces or special category spaces.

1.3.4 Ro-ro spaces *(1/1/2012)*

Ro-ro spaces are spaces not normally subdivided in any way and normally extending to either a substantial length or the entire length of the ship, in which motor vehicles with fuel in their tanks for their own propulsion and/or goods (packaged or in bulk, in or on rail or road cars, vehicles (including road or rail tankers), trailers, containers, pallets, demountable tanks or in or on similar stowage units or, other receptacles) can be loaded and unloaded normally in a horizontal direction.

1.3.5 Special category spaces *(1/1/2012)*

Special category spaces are those enclosed vehicle spaces above or below the bulkhead deck, into and from which vehicles can be driven and to which passengers have access. Special category spaces may be accommodated on more than one deck provided that the total overall clear height for vehicles does not exceed 10 m.

1.3.6 Securing device *(1/1/2012)*

A securing device is a device used to keep the door closed by preventing it from rotating about its hinges.

1.3.7 Supporting device *(1/1/2012)*

A supporting device is a device used to transmit external or internal loads from the door to a securing device and from the securing device to the ship's structure, or a device other than a securing device, such as a hinge, stopper or other fixed device, that transmits loads from the door to the ship's structure.

1.3.8 Locking device *(1/1/2012)*

A locking device is a device that locks a securing device in the closed position.

1.3.9 Close-up survey *(1/1/2012)*

A close-up survey is a survey where the details of structural components are within the close visual inspection range of the Surveyor, i.e. normally within reach of hand.

2 Ro-ro cargo ships, Car Carrier - Annual survey

2.1 Shell and inner doors

2.1.1 Scope of survey *(1/1/2012)*

The survey is to consist of an examination to verify, as far as is practicable, that the bow, inner, side shell and stern doors are maintained in a satisfactory condition.

2.1.2 Unapproved changes *(1/1/2012)*

Confirmation is to be obtained that no unapproved changes have been made to the bow, inner, side shell and stern doors since the last survey.

2.1.3 Documents *(1/1/2012)*

If an Operating and Maintenance Manual (OMM) is required, it is to be verified that an approved copy is on board and any possible modifications are included.

It is to be verified that documented operating procedures for closing and securing doors are kept on board and posted at an appropriate place.

The Surveyor is to examine the OMM with special attention to the register of inspections and its contents as a basis for the survey.

2.1.4 Structural examination *(1/1/2012)*

Bow, inner, side shell and stern doors are to be examined with particular attention paid to:

a) structural arrangement of doors including plating, secondary stiffeners, primary structure, hinging arms and welding;

b) shell structure surrounding the opening of the doors and the securing, supporting and locking devices including shell plating, secondary stiffeners, primary structure and welding;

c) hinges and bearings, thrust bearings;

d) hull and door side supports for securing, supporting and locking devices;

e) close-up survey of securing, supporting and locking devices including welding, in accordance with the requirements given in Tab 1.

Whenever a crack is found, an examination with NDT is to be carried out in the surrounding area and for similar items as considered necessary by the Surveyor.

2.1.5 Measurement of clearances *(1/1/2012)*

Clearances of hinges, bearings and thrust bearings are to be taken, where no dismantling is required. Where the function test is not satisfactory, dismantling may be required to measure the clearances. If dismantling is carried out, a visual examination of hinge pins and bearings together with NDT of the hinge pin is to be carried out. Clearances of securing, supporting and locking devices are to be measured, where indicated in the OMM.

2.1.6 Sealing arrangement *(1/1/2012)*

An examination of packing material/rubber gaskets and retaining bars or channels, including welding, is to be carried out.

2.1.7 Drainage arrangement *(1/1/2012)*

An examination of drainage arrangement, including bilge wells and drain pipes, where fitted, is to be carried out. A test of the bilge system between the inner and outer doors is to be carried out.

2.1.8 Function test of doors *(1/1/2012)*

A check of the satisfactory operation of the bow, inner, side shell and stern doors during a complete opening and closing operation is to be made, as applicable, including:

a) proper working of the hinging arms and hinges;

b) proper engagement of the thrust bearings;

c) device for locking the door in the open position;

d) securing, supporting and locking devices;

e) proper sequence of the interlock system for the opening/closing system and the securing and locking devices;

f) mechanical lock of the securing devices;

g) proper locking of hydraulic securing devices in the event of a loss of the hydraulic fluid, according to the procedure provided by the OMM;

h) correct indication of open/closed position of doors and securing/locking devices at navigation bridge and other control stations;

i) isolation of the hydraulic securing/locking devices from other hydraulic systems;

j) confirmation that the operating panels are inaccessible to unauthorised persons;

k) verification that a notice plate giving instructions to the effect that all securing devices are to be closed and locked before leaving harbour is placed at each operating panel and supplemented by warning indicator lights;

l) examination of electrical equipment for opening, closing and securing the doors.

2.1.9 Function test of the indicator system *(1/1/2012)*

A check of the satisfactory operation of the indicator system, where fitted, is to be carried out, as applicable, including:

a) proper visible indication and audible alarm on the navigation bridge panel, according to the selected function "harbour/sea voyage" and on the operating panel;

b) lamp test function on both panels;

c) verification that it is not possible to turn off the indicator light on both panels;

d) verification of fail-safe performance, according to the procedure provided by the OMM;

e) confirmation that power supply for the indicator system is supplied by the emergency source or other secure power supply and independent of the power supply for operating the doors;

f) proper condition of sensors and protection from water, ice formation and mechanical damage.

2.1.10 Test of water leakage detection system *(1/1/2012)*

Where fitted, the water leakage detection system is to be tested including proper audible alarm on the navigation bridge panel and on the engine control room panel, according to the procedure provided by the OMM.

2.1.11 Test of television surveillance system *(1/1/2012)*

Where fitted, the television surveillance system is to be tested including proper indication on the navigation bridge monitor and on the engine control room monitor.

2.1.12 Tightness test *(1/1/2012)*

A hose test or equivalent is to be carried out. If the visual examination and function test have shown satisfactory results, the tightness test of shell doors on ro-ro cargo ships need not be carried out unless considered necessary by the attending Surveyor.

2.1.13 NDT and thickness measurements *(1/1/2012)*

When considered necessary by the Surveyor, NDT and thickness measurements may be required after visual examination and function test.

2.2 Internal platforms and ramps

2.2.1 The annual survey of internal movable platforms and ramps (excluding those considered as inner doors and covered in [2.1]) and related equipment consists of:

- a general examination of the installation, particular attention being paid to the condition of steel cables
- confirmation of the proper operation of platforms/ramps and of mechanical stops and locks
- checking, as far as practicable, of the alarms and safety devices.

2.3 Fire protection, detection and extinction

2.3.1 *(1/7/2012)*

Within the scope of survey of fire protection, detection and extinction arrangements as required for the annual survey of all ships in Ch 3, Sec 3, [3.5], attention is to be given to the particular arrangements related to ro-ro cargo spaces, such as:

- fire detection systems and alarms
- electrical equipment of a safe type.

2.4 Drainage in ro-ro space/special category spaces protected by drenching system

2.4.1 *(1/1/2023)*

Visual examination of the drainage facilities for blockage or other damage is to be carried out and it is to be confirmed that means to prevent blockage of drainage arrangements are provided for closed vehicle and ro-ro spaces and special category spaces where fixed pressure water-spraying systems are used.

3 Ro-ro cargo ships, Car Carrier - Class renewal survey

3.1 Shell and inner doors

3.1.1 Scope of survey *(1/1/2012)*

The class renewal survey is to include, in addition to the requirements of the annual survey as stated in [2.1], examination, tests and checks of sufficient extent to verify that the bow, inner, side shell and stern doors are in satisfactory condition and considered able to remain in compliance with applicable requirements, subject to proper maintenance and operation in accordance with the Operation and Maintenance Manual (OMM) or the Manufacturer's recommendations and the periodical surveys being carried out at the due dates for the five-year period until the next class renewal survey.

3.1.2 Thickness measurements and testing *(1/1/2012)*

The examinations of the doors are to be supplemented by thickness measurements and testing to verify compliance with applicable requirements so that the structural and weathertight integrity remain effective. The aim of the examination is to identify corrosion, significant deformation, fractures, damages or other structural deterioration, that may be present.

3.1.3 Survey of doors *(1/1/2012)*

The bow, inner, side shell and stern doors are to be surveyed as follows.

a) A survey of the items listed in [2.1.4], including close-up survey of securing, supporting and locking devices, together with welding, is to be carried out in accordance with the requirements given in Tab 1.

b) Non-destructive testing and thickness measurements are to be carried out on securing, supporting and locking devices, including welding, to the extent considered necessary by the Surveyor. Whenever a crack is found, an examination with NDT is to be carried out in the surrounding area and for similar items as considered necessary by the Surveyor.

c) The maximum thickness diminution of hinging arms, securing, supporting and locking devices is not to be more than 15% of the as-built thickness.

d) A check of the effectiveness of sealing arrangements by hose testing or equivalent is to be carried out.

e) Clearances of hinges, bearings and thrust bearings are to be taken. Unless otherwise specified in the OMM or recommended by the Manufacturer, the measurement of clearances on ro-ro cargo ships may be limited to representative bearings where dismantling is needed in order to measure the clearances. If dismantling is carried out, a visual examination of hinge pins and bearings together with NDT of the hinge pin is to be carried out.

f) The non-return valves of the drainage system are to be dismantled and examined.

SECTION 1 GENERAL

1 General

1.1

1.1.1 The purpose of this Chapter is to give details on the scope of surveys of specific equipment and systems fitted on board the ship, which are covered by an additional class notation. Unless otherwise specified in Ch 1, Sec 2, [6], the scope of these surveys provides the requirements to be complied with for the maintenance of the relevant additional class notation.

1.1.2 These specific requirements are additional to those laid down in Chapter 3 and Chapter 4. These surveys are to be carried out at intervals as described in Ch 2, Sec 2, as far as possible concurrently with the surveys of the same type, i.e. annual, intermediate or class renewal survey.

1.1.3 The equipment and systems are also to be submitted to occasional survey whenever one of the cases indicated in Ch 2, Sec 2, [11] occurs.

1.1.4 Where specific requirements are given in this Chapter for the class renewal survey, they are additional to the applicable requirements for the annual survey.

1.1.5 For the assignment of the additional class notations, ships are to be submitted to an admission to class survey as described in Ch 2, Sec 1, [2] and Ch 2, Sec 1, [3] for new and existing installations, respectively, as applicable.

2 Additional class notations subject to additional surveys

2.1

2.1.1 The specific requirements detailed in this Chapter are linked to the additional class notation(s) assigned to the ship. Where a ship has more than one additional class notation, the specific requirements linked to each additional class notation are applicable as long as they are not contradictory.

2.1.2 Tab 1 indicates which additional class notations are subject to specific requirements, and in which Section and/or Article they are specified.

Table 1 : Additional class notations for which specific survey requirements are applicable *(1/1/2023)*

Additional class notation	Section or Article applicable in this Chapter	Type of surveys affected by these specific requirements	Remarks
STAR **STAR-HULL** **STAR-MACH**	Sec 2	See Remarks	The scope and periodicity of surveys are stipulated by specific requirements given in Pt F, Ch 1, Sec 1, [5] and Pt F, Ch 1, Sec 2, [4]
Availability of machinery: **AVM-APS** **AVM-IAPS** **AVM-DPS** **AVM-IPS**	Sec 3	annual survey class renewal survey	
Automated machinery systems: **AUT-UMS** **AUT-CCS** **AUT-PORT**	Sec 4	annual survey class renewal survey	
Integrated ship systems: **SYS-NEQ** **SYS-NEQ-1** **SYS-COM** **SYS-IBS**	Sec 5	annual survey class renewal survey	
Monitoring equipment: **MON-HULL** **MON-SHAFT**	Sec 6	annual survey class renewal survey tailshaft survey	

Additional class notation	Section or Article applicable in this Chapter	Type of surveys affected by these specific requirements	Remarks
HELIDECK **HELIDECK H**	Sec 11	annual survey class renewal survey	
Other notations **STRENGTHBOTTOM-NAABSA** **GRABLOADING - GRAB [X]** **SPM** **LASHING** and **ROUTE DEPENDENT LASHING** **DYNAPOS** **DP PLUS** **VCS** **COVENT** **CARGOCONTROL** **COAT-WBT** **DIVINGSUPPORT** **HVSC** **HVSC-NB** **FIRE** **SELF-UNLOADING** **TAS** **EFFICIENT SHIP (S,DWT)** **MOORING** **CARGO HANDLING AND PERSONNEL LIFTING** **G SAHARA, SAHARA** **COMF NOISE, COMF-VIB, DOLPHIN QUIET SHIP, DOLPHIN TRANSIT SHIP** **RISK MITIGATION (…)** **AIR MON** **DANGEROUS GOODS** **INF 1, INF 2, INF 3** **INERTGAS A, INERTGAS B, INERTGAS C** **~~GAS~~LNG FUELLED, CNG FUELLED** **~~GAS~~LNG FUELLED (Main), CNG FUELLED (Main)** **~~GAS~~LNG FUELLED (Aux), CNG FUELLED (Aux)** **MAN OVERBOARD DETECTION SYSTEM** **CYBER RESILIENCE** **DIGITAL SHIP (ADC)** **AIR LUBRICATION SYSTEM** **PERSONS WITH REDUCED MOBILITY (PMR-ITA)** **BIOSAFE SHIP** **REMOTE SURVEYABLE SHIP (REMOTE)** **SUSTAINABLE SHIP** **MARITIME AUTONOMOUS SURFACE SHIPS (MASS)** **ENHANCED MAINTENANCE (EM)** **CARGO PIPING PROTECTED (CPP)** **NOISE-PORT-OUT(X)** **NOISE-PORT-IN(X)** **COATING PERFORMANCE STANDARD IN CARGO OIL TANKS (CPS-COT)** **DIGITAL SHIP (D)** **FUEL SAMPLING**	Sec 12	As applicable in accordance with the related Articles in Sec 12	

SECTION 12 OTHER NOTATIONS

1 General

1.1

1.1.1 *(1/1/2023)*

The requirements of this Section apply to ships which have been assigned one of the following additional class notations described in Ch 1, Sec 2, [6.14]:

STRENGTHBOTTOM-NAABSA

GRABLOADING

GRAB [X]

SPM

LASHING and **ROUTE DEPENDENT LASHING**

DYNAPOS

DP PLUS

VCS

COVENT

CARGOCONTROL

COAT-WBT

DIVINGSUPPORT

HVSC-NB, HVSC

FIRE

SELF-UNLOADING

TAS

EFFICIENT SHIP (S, DWT)

MOORING

CARGO HANDLING AND PERSONNEL LIFTING

SAHARA, SAHARA

COMF NOISE, COMF-VIB~~NOISE-PORT~~, DOLPHIN QUIET SHIP, DOLPHIN TRANSIT SHIP

RISK MITIGATION

AIR MON

DANGEROUS GOODS

INF 1, INF 2, INF 3

INERTGAS A, INERTGAS B, INERTGAS C

~~GAS~~LNG FUELLED, ~~GAS~~LNG FUELLED (Main), ~~GAS~~LNG FUELLED (Aux)

CNG FUELLED, CNG FUELLED (Main), CNG FUELLED (Aux)

MAN OVERBOARD DETECTION SYSTEM

CYBER RESILIENCE

DIGITAL SHIP (ADC)

AIR LUBRICATION SYSTEM

PERSONS WITH REDUCED MOBILITY (PMR-ITA)

BIOSAFE SHIP

REMOTE

SUSTAINABLE SHIP

MARITIME AUTONOMOUS SURFACE SHIPS (MASS)

ENHANCED MAINTENANCE (EM)

CARGO PIPING PROTECTED (CPP)

NOISE-PORT-OUT(X), NOISE-PORT-IN(X)

COATING PERFORMANCE STANDARD IN CARGO OIL TANKS (CPS-COT)

DIGITAL SHIP (D)

FUEL SAMPLING

2 STRENGTHBOTTOM-NAABSA

2.1 Dry-docking survey

2.1.1 The reinforced area of bottom plating and internal associated structures are to be visually examined for possible deformations, fractures or other damage. If deemed necessary, thickness measurements may be required.

3 GRABLOADING and GRAB [X]

3.1 Class renewal survey

3.1.1 The reinforced area of double bottom plating and adjacent associated structures are to be visually examined for possible deformations, fractures or other damage. If deemed necessary, thickness measurements may be required.

4 SPM

4.1 Annual survey

4.1.1 The Owner or his representative is to declare to the attending Surveyor that no significant alterations have been made without the prior approval of the Society.

4.1.2 The annual survey is to include:

- a general examination of all components of the installation (bow chain stoppers, bow fairleads, pedestal roller fairleads, winches and capstans) to verify their satisfactory condition
- an examination of the hull structures supporting and adjacent to the installation to verify that no deformations or fractures have developed.

4.2 Class renewal survey

4.2.1 The class renewal survey is to include:

- a close-up examination of all components of the installation (bow chain stoppers, bow fairleads, pedestal roller fairleads, winches and capstans) to verify their satisfactory condition

b) examination of the monitoring system, including a random check of the proper operation of sensors and equipment;

c) examination of evidence that maintenance of monitoring system has been carried out in accordance with maker's instruction.

In case the fuel consumption is measured through a periodic stocktakes of fuel tanks (see Pt F, Ch 13, Sec 19, [5.2]), the survey is to include the examination of evidence that, in the period subsequent to the last survey, the checks have been carried out with the frequency and the methodology described in the procedure previously examined and accepted by the Society.

18 MOORING

18.1 Annual survey

18.1.1 *(1/7/2014)*

The Owner or his representative is to declare to the attending Surveyor that no significant alterations have been made without the prior approval of the Society.

18.1.2 *(1/7/2014)*

Scope of the annual survey is to determine the condition of the mooring system on the basis, as far as practicable, of an examination of above water items in order to verify their satisfactory condition.

In particular, the following items are to be examined:

- Anchor chain stopper structural arrangements and relevant foundations
- Anchor chain catenary angles to verify compliance with design values. In the case of anchor cables, their tensions are to be checked against allowable tensions
- Cable or chain in contact with fairleads, etc.
- Cable or chain in way of winches, stoppers and splash zone.

18.2 Renewal survey

18.2.1 *(1/7/2014)*

The requirements for annual surveys in [18.1.1] are to be complied with.

18.2.2 *(1/7/2014)*

Where practicable, mooring cables, chains and anchors are to be lifted to the surface for detailed inspection in accordance with [18.2.3] and [18.2.4] at each Renewal Survey.

Alternatively, in situ inspection, using acceptable techniques, will be considered by the Society when requested by the interested parties.

18.2.3 *(1/7/2014)*

As far as practicable, the surveyor is to determine the general condition of the mooring system including cables, chains, fiber ropes, fittings, fairleads, connections and equipment.

Particular attention is to be given to the following:

- cable or chain in contact with fairleads, etc,
- cable or chain in way of winches and stoppers
- cable or chain in way of the splash zone
- cable or chain in the contact zone of the sea bed
- damage to mooring system
- extent of marine growth
- condition and performance of corrosion protection.

18.2.4 *(1/7/2014)*

Wire rope anchor cables are to be examined. If cables are found to contain broken, badly corroded or bird caging wires they are to be renewed.

Chain cables are to be examined. Maximum acceptable diminution of anchor chain in service will normally be limited to a two per cent reduction from basic chain diameter. (Basic chain diameter can be taken as the diameter, excluding any design corrosion allowance, which satisfies the Rule requirement for minimum factors of safety).

18.2.5 *(1/7/2014)*

The windlasses or winches are to be examined.

18.2.6 *(1/7/2014)*

Structure in way of anchor racks and anchor cable fairleads is to be examined.

19 CARGO HANDLING AND PERSONNEL LIFTING

19.1 General

19.1.1 *(1/1/2023)*

Cargo handling systems covered by the additional Class notation **CARGO HANDLING** are those, but not limited to, having the configuration of a:

- crane
- slewing crane
- gantry travelling crane
- portal cranes
- swinging jib crane
- deck cargo jib crane
- container crane
- fixed crane with derrick or retractable jib
- A-frame crane.

Crane or lifting arrangements covered by the additional class notation **PERSONNEL LIFTING** are those intended to be used for personnel lifting which complies with the "Rules for loading and unloading arrangements and for other lifting appliances on board ships or other similar units" and, for the notations **PERSONNEL LIFTING+** and **PERSONNEL LIFTING++**, also with the requirements in Pt F, Ch 13, Sec 42.

19.2 Annual survey

19.2.1 *(1/7/2014)*

The Owner or his representative is to declare to the attending Surveyor that no significant alterations have been made without the prior approval of the Society.

19.2.2 *(1/1/2023)*

The annual survey is to include:

- an examination of the instruction/installation manual to verify the layout of the complete system and confirm correspondence to the actual system(s) fitted on board
- verification that maintenance of the system(s) has been carried out according to the Manufacturer's instructions and schedules

- examination of the structural parts, including bolts and welds, of the cargo handling system, such as foundations, columns, fixed structure of the crane, arm, jib, jib heel pins, jib slewing rings, fixed sheaves, blocks, axle pins and housings
- examination of hydraulic cylinders, winches (electrical and/or hydraulically driven), driving motors and related attachments
- examination of the electrical systems, switchboard, etc)
- examination of the components and loose gears, such as shackle, links, rings, hooks, etc, in order to verify their satisfactory condition of maintenance
- examination of all cables (spans, runners, maneuvering cables) with particular attention to their ends and terminal fittings
- verification and test of the alarm and safety devices
- a running test of the system in order verify the satisfactory working and operation conditions.
- verification of compliance with the requirements in Pt F, Ch 13, Sec 42 in case of **PERSONNEL LIFTING** notation.

19.3 Renewal survey

19.3.1 *(1/7/2014)*

The requirements for annual surveys in [19.~~1.1~~2] are to be complied with.

19.3.2 *(1/7/2014)*

- Working test of the hydraulic oil system(s), as applicable, pertaining to the cargo handling system(s)
- insulation tests of all electrical equipment of the crane(s)
- overload test is to be performed with test loads as shown in Tab 1.

  The winch of the system is to be able to raise a test load of at least 1.1 P and to support the full test load even if it cannot raise it.

  When due to the pressure valve setting, hydraulic cranes cannot raise the full test load, a smaller test load may be accepted but in no case is it to be less than 1.1P.

  For variable load-radius cranes, the jib is to be tested with the above-mentioned test load, for maximum and minimum jib outreach. For cranes or similar lifting appliances having variable working load as a function of the luffing, the most severe testing conditions resulting from the diagrams of the approved forces are to be considered both for structures and fittings.

  During the test, it is necessary to verify that each gear tooth is subjected to stress.

  For travelling cranes, the test load is to be traversed slowly over the full length of the track.

  The suspended load is to be as lateral as possible, and it is to be tested for working on both port and starboard sides of the ship.

  Following the overload test, the crane is to be subjected to testing of the brakes for all movements at maximum speed with suspended load. For cranes slewing over a range of 360°, the slewing test includes two complete turns from starting position.

  All limit switches are to be tested.

Table 1 *(1/7/2014)*

Working load P, in kN	Test load, in kN
P ≤ 200	1,25 P
200 < P ≤ 500	P + 50
P > 500	1,10 P

After testing, fixed structures and associated gear are to be disassembled and examined where necessary. The tests and inspections are not to reveal deformations or unacceptable defects.

20 ☪ SAHARA and SAHARA

20.1 Annual survey

20.1.1 *(1/7/2014)*

The Owner or his representative is to declare to the attending Surveyor that no significant alterations have been made without the prior approval of the Society.

The annual survey is to include:

- examination, where fitted, of the wooden sheathing protecting the cargo deck
- verification from the on-board records that performance of the fresh water generator(s) is regularly monitored
- visual examination of mechanical components used for cooling and maintaining an ambient temperature, including the test of the audible and visual alarms fitted, at a continually manned control station, to indicate any malfunction of the cooling units.

20.2 Renewal survey

20.2.1 *(1/7/2014)*

The requirements for annual surveys in [20.1.1] are to be complied with.

20.2.2 *(1/7/2014)*

Internal examination and working test of fresh water generator (s).

21 COMF-NOISE, COMF-VIB~~NOISE-PORT~~, DOLPHIN QUIET SHIP, DOLPHIN TRANSIT SHIP

21.1 Renewal survey

21.1.1 *(1/7/2014)*

Verification that the ship has not been subjected to modifications, refitting or major repairs that may affect its level of comfort.

In particular, the following items have to be verified:

- main engine(s)
- propulsion shafting and its components such as reduction gear (if fitted), intermediate bearings, etc.
- propeller(s)
- air-conditioning System(s) and Ventilation System(s), including their intake and delivery ducts or plenum.

22 RISK MITIGATION (…)

22.1 Annual and renewal survey

22.1.1 *(1/7/2015)*

The verifications to be carried out at periodical surveys are established on a case by case basis according to the measures adopted in order to reduce the risk of failures of the specific technical matters indicated between brackets in the notation itself.

23 AIR MON

23.1 Annual and renewal survey

23.1.1 *(1/7/2015)*

The survey is to include:

a) verification that the maintenance and inspection of the HVAC system are carried out according to the makers recommendations and internal procedures;

b) checking that the monitoring plan is available, updated and implemented;

c) checking the reports of the required analysis and their review for compliance as evidence of monitoring plan implementation.

In addition, a record of extraordinary maintenance, repairs, equipment modifications (if any) and the results of relevant tests carried out is to be available.

24 DANGEROUS GOODS

24.1 Annual and renewal survey

24.1.1 *(1/7/2015)*

The survey is to include:

a) verification that the "Record for the Carriage of Dangerous Goods in Packaged Form and Dangerous Solid Cargoes in Bulk" is present on board;

b) verification, when appropriate, that there is a special list, manifest or stowage plan for the carriage of dangerous goods;

c) verification, as applicable, that the approved Cargo Securing Manual, according to (SOLAS 74/2011 Reg.VII/5) is present on board (applicable only to dangerous goods in package form)

d) verification of the consistency and efficiency of the specific constructional and carriage requirements imposed for the carriage of the goods listed in the "Record for the Carriage of Dangerous Goods in Packaged Form and Dangerous Solid Cargoes in Bulk".

25 INF 1, INF 2, INF 3

25.1 Annual and renewal survey

25.1.1 *(1/7/2015)*

The survey is to include:

a) verification that the "Damage Stability booklet", related to the carriage of INF materials, is present on board;

b) verification that the "shipboard emergency plan", related to the carriage of INF materials, is present on board;

c) verification of additional arrangements, if any, for radiological protection related to the carriage of INF materials;

d) verification of additional equipment, if any, for radiological protection related to the carriage of INF materials;

e) verification of the permanent securing devices provided to prevent movement of the packages within the cargo spaces;

f) verification of the efficiency of the ventilation, or refrigeration, of enclosed cargo spaces and relevant control, safety and alarm systems;

g) test and verification of the fixed cargo space cooling arrangements;

h) test of the water fire-extinguishing system;

i) test and verification of the fixed fire detection and fire alarm system.

26 INERTGAS A, INERTGAS B, INERTGAS C

26.1 Annual survey

26.1.1 *(1/7/2016)*

For the additional class notations **INERTGAS A** and I**INERTGAS C** the survey is carried out according the requirements of Ch 4, Sec 3, [3.3].

26.1.2 *(1/7/2016)*

For the additional class notations **INERTGAS B** the survey is to include, according to the type of system installed:

a) external examination of the whole system, to check the condition of all piping, including vent piping above the upper deck in the cargo tank area and overboard discharges through the shell so far as practicable, and associated components to verify, in particular, the absence of signs of corrosion and leakage of gas, water or other liquid from inert gas and water piping systems

b) check of proper operation of both inert gas blowers or, in case of a nitrogen generator, of the compressor(s)

c) check of proper operation of ventilation system required for scrubber room (if any). In case of nitrogen generators verify the proper operations of the ventilation system of the nitrogen generator room (if any), and the extraction system of the nitrogen buffer tank room (if any)

d) check of deck water seal for automatic water filling and draining

e) check of absence of water carry over in the inert gas from the deck water seal and check of the condition of the non-return valve In case of nitrogen generator verify the condition of the no return devices

f) check of proper operation of all remotely operated or automatically controlled valves and, in particular, of the flue gas isolating valve located on the inert gas supply main after the blowers. For the nitrogen generators check the proper operation of the insulation valves between the generator and the buffer tank(s)

g) check of proper operation of the interlocking feature fitted to prevent soot blowers from operating when the inert gas system is working

h) check that the gas pressure regulating valve automatically closes when gas blowers are stopped

i) check, as far as practicable and using simulated conditions where necessary, of the following alarms and safety devices of the inert gas system:

1) high oxygen content of gas in the inert gas main

2) low gas pressure in the inert gas main

3) accuracy of portable and fixed oxygen measuring equipment by means of calibration gases

4) high pressure of gas in the inert gas main

In addition for the nitrogen generator check the following alarms and safety devices:

5) temperature and pressure devices of the suction side of the generator

6) electric failure alarm

7) high level alarm of condensate in the system

8) low feed alarm or low pressure alarm at the delivery side of air compressor(s)

9) high temperature alarm at the delivery side of air compressor(s).

j) check, when practicable, of the proper operation of the inert gas system on completion of the checks listed above.

26.2 Renewal survey

26.2.1 *(1/7/2016)*

For the additional class notations **INERTGAS A** and **INERTGAS C** the survey is carried out according the requirements of Ch 4, Sec 3, [5.2].

26.2.2 *(1/7/2016)*

For the additional class notation **INERTGAS B** the survey is to include, according to the type of system installed.

26.2.3 *(1/7/2016)*

For ships over 10 years old at the time of the intermediate survey due date, the following is to be carried out::

- main parts such as the scrubber, washing machines, blowers, deck water seal and non-return valve are to be opened out as considered necessary and examined
- gas distribution lines and shut-off valves, including soot blower interlocking devices, are to be examined as deemed necessary
- all automatic shutdown devices and alarms are to be examined and tested.

27 ~~GAS~~LNG FUELLED and CNG FUELLED additional class notations (~~GAS~~LNG FUELLED, CNG FUELLED, ~~GAS~~LNG FUELLED (Main), CNG FUELLED (Main), ~~GAS~~LNG FUELLED (Aux), CNG FUELLED (Aux))

27.1 Annual survey

27.1.1 Ship other than liquefied gas carriers *(1/1/2023)*

For the additional class notations ~~GAS~~LNG **FUELLED** and CNG FUELLED the survey is carried out according to the requirements of Ch 3, Sec 9, [1.2].

27.1.2 Liquefied gas carriers *(1/1/2023)*

For the additional class notations ~~GAS~~LNG **FUELLED** and CNG FUELLED the survey is carried out according to the requirements of Ch 3, Sec 9, [2.1].

27.2 Intermediate Survey

27.2.1 Ship other than liquefied gas carriers *(1/1/2023)*

For the additional class notations ~~GAS~~LNG **FUELLED** and CNG FUELLED the survey is carried out according to the requirements of Ch 3, Sec 9, [1.3].

27.2.2 Liquefied gas carriers *(1/1/2023)*

For the additional class notations ~~GAS~~LNG **FUELLED** and CNG FUELLED the survey is carried out according to the requirements of Ch 3, Sec 9, [2.2].

27.3 Renewal survey

27.3.1 Ship other than liquefied gas carriers *(1/1/2023)*

For the additional class notations ~~GAS~~LNG **FUELLED** and CNG FUELLED the survey is carried out according to the requirements of Ch 3, Sec 9, [1.4].

27.3.2 Liquefied gas carriers *(1/1/2023)*

For the additional class notations ~~GAS~~LNG **FUELLED** and CNG FUELLED the survey is carried out according to the requirements of Ch 3, Sec 9, [2.3].

28 MAN OVERBOARD DETECTION SYSTEM

28.1 Annual survey

28.1.1 *(1/11/2018)*

For maintaining the additional class notation **MOB,** the Man Overboard Detection System is to be surveyed periodically in order to confirm that the operational conditions are satisfactory.

A reasonable number of dropping tests - not less than 4 - is to be carried out in specific ship's areas, identified taking into account

the system history in terms of detection failures and false alarms.

Any modification to the ship which may affect the MOB performance and/or any modification to the MOB system itself modification is to be checked and recorded in accordance with relevant operational procedures.

28.2 Renewal survey

28.2.1 *(1/11/2018)*

During renewal surveys, in addition to [28.1.1], verifications are to carried out to ensure that the MOB detection system complies with the requirements in Pt F, Ch 13, Sec 27, [6].

29 CYBER RESILIENCE

29.1 Annual survey and renewal survey

29.1.1 *(1/1/2019)*

The scope of annual and renewal surveys for maintaining the additional class notations **CYR**, **CYR-OT** and **CYR-IT** is given in Pt F, Ch 13, Sec 29, [1.3.2].

30 DIGITAL SHIP (ADC)

30.1 Annual survey and renewal survey

30.1.1 *(1/1/2023)*

For maintaining the additional class notation **DIGITAL SHIP (ADC)**, the data collection system is to be assessed~~surveyed~~ periodically (yearly), found in good working conditions and capable to transfer data (either as collected or elaborated as necessary)~~on~~ ashore. These ascertainments are carried out from a remote connection (e.g. without a visit on board) and data are to be made available on RINA Cube for the assessment time period.

Real time data availability from the connected ship is also to be ascertained.

Any modification to the data collection system and to the software release is to be found properly recorded.

31 AIR LUBRICATION SYSTEM

31.1 Annual, intermediate and renewal surveys

31.1.1 Annual and intermediate surveys *(1/4/2019)*

The following tests and inspections are to be performed:

- visual inspection of piping system and operational test of valves,
- functional tests of the whole system, including its monitoring, alarm and safety systems.

31.1.2 Renewal survey *(1/4/2019)*

The following tests and inspections are to be performed in addition to those due for annual and intermediate surveys:

- internal inspection of air receivers or hydrostatic test of air bottles,
- overhauling and test of safety valves,
- overhauling and test of devices to prevent the return in safe space of atmosphere from the dangerous zone, if any,
- visual inspection and tightness test of hull and watertight boundaries' penetrations,
- visual inspection of piping system and operational test of valves,
- leakage test of piping,
- measurement of insulation resistance of electric plant,
- functional tests of the whole system under working condition, including its monitoring, alarm and safety systems.

31.2 Bottom survey

31.2.1 *(1/4/2019)*

The following tests and inspections are to be performed:

- overhauling of valves at hull penetrations (air distributor connection) once for every class period.

32 PERSONS WITH REDUCED MOBILITY (PMR-ITA)

32.1 Annual survey and renewal survey

32.1.1 *(13/12/2019)*

For maintaining the additional class notation **PMR-ITA**, the ship is to be surveyed periodically in order to confirm that the requirements for the carriage of PMR are fulfilled.

Any modification to the ship which may affect the requirements for PMR is to be checked and recorded.

The annual and renewal surveys are to include:

a) verification of availability onboard of up-to date documentation as requested in Pt F, Ch 13, Sec 32, Tab 1

b) verification that ship's arrangement related to PMR are unchanged and as described in the drawings

c) verification that relevant PMR procedures are still in force and regularly implemented

d) check that any ship's modification is still in compliance with the requirements for PMR and updated in any relevant drawing and procedure

e) execution of spot tests to check ship's accessibility by a PMR.

33 BIOSAFE SHIP

33.1 Annual and class renewal survey

33.1.1 *(15/6/2020)*

The survey is, as far as practicable, to include the following checks:

a) verification that a responsible person is appointed as Ship Health Officer and is present on board,

b) verification that all the additional systems and components involved in the ship's BIOSAFE index calculation (see Pt F, Ch 13, Sec 33, Tab 2 and Pt F, Ch 13, Sec 33, [6], if any) are well maintained and in good working condition;

c) verification that all the additional procedural means involved in the ship's BIOSAFE index calculation (see Pt F,

Ch 13, Sec 33, Tab 2 and Pt F, Ch 13, Sec 33, [6], if any) are followed and documented by appropriate recording;

d) verification that adequate training on health issues is planned, carried out and documented for all the persons on board having influence on the health behaviour of the ship.

34 REMOTE

34.1 Annual and class renewal survey

34.1.1 *(1/1/2023)*

For maintaining the additional class notation **REMOTE**, the devices for live-streaming and the Connectivity Kit are to be surveyed ~~periodically (yearly)~~ and found to be available on board and operational. The presence on board of at least one of the ship's Officers provided with the Certificate of Competency requested in Pt F, Ch 13, Sec 34, [2.4] is also to be ascertained.

35 SUSTAINABLE SHIP

35.1 Annual and class renewal survey

35.1.1 *(1/1/2023)*

For maintaining the additional class notation **SUSTAINABLE SHIP**, the survey is, as far as practicable, to include the checks in:

- [33] for the **BIOSAFE SHIP** additional class notation;
- Sec 7, [4] for the Environmental Index defined in the **GREEN PLUS** additional class notation; ~~and~~
- [21] with reference to **COMF-NOISE** ~~and **COMF-NOISE-PORT(X)**~~ additional class notation~~s.~~; and
- [39] with reference to **NOISE-PORT-OUT(X)** and **NOISE-PORT-IN(X)** additional class notations.

36 MARITIME AUTONOMOUS SURFACE SHIPS (MASS)

36.1 Annual and class renewal survey

36.1.1 *(1/10/2021)*

The scope of annual and renewal surveys for maintaining the **MASS** additional class notations is given in Pt F, Ch 13, Sec 37.

37 ENHANCED MAINTENANCE (EM)

37.1 Annual and class renewal survey

37.1.1 *(1/11/2022)*

The Owner or his representative is to declare to the attending Surveyor that no significant alterations have been made without the prior approval of the Society.

The annual audit is to include ascertainment on board and at the Company Office as follows:

- confirmation of availability of the three-dimensional model structural analysis at the Company office
- confirmation of availability of an approved Planned Maintenance System (PMS) including the related risk assessment both on board and at the Company office
- confirmation of availability of an approved Inspection and Maintenance Plan (IMP) on board and at the Company office
- review inspection and maintenance report, on board and at the Company office
- check the role assignment for personnel responsible for the correct implementation of both PMS and IMP and for those entrusted with the inspections, on board and at the Company office.

37.2 Renewal audit

37.2.1 *(1/11/2022)*

The renewal audit is carried out concurrently with the class renewal survey and, in addition to the ascertainment prescribed for the annual audit, consist of:

- check condition of the structure included in the PMS and IMP
- cross check of consistency between survey outcome and data recorded in the crew/Company personnel's inspection reports.

38 CARGO PIPING PROTECTED (CPP)

38.1 Annual and class renewal survey

38.1.1 *(1/1/2023)*

For maintaining the additional class notation **CPP**, all cargo piping and valve control piping are be surveyed periodically to confirm their compliance with the following:

- piping of all cargo handling systems is to be electrically bonded to the ship's hull; the resistance to earth from any point in the piping system is not to exceed 10^6 Ω
- valves or branch pieces, which connect the cargo pipeline's shore connection on deck, and cargo piping are to be supported with due regard to load stresses
- the cargo piping system is not to have any connection to permanent ballast tanks
- isolation of cargo piping connections to sea chest is to be made by means of either:
  - a blank flange or a removable spool piece with a shut-off valve on each side of the blank flange or the removable spool piece; or
  - two valves at the sea chest connection, one capable of being locked in closed position and with means - such as a test cock - for detecting leakage past these valves
- the complete cargo piping system, except for bow and stern loading systems, is to be located within the cargo area
- thickness is to be measured at random or selected pipe lengths to be opened for internal inspection, as deemed necessary

- piping is to be tested to the maximum working pressure, if required
- watertight penetrations are to be examined as far as practicable
- cargo, crude oil washing, bunker and vent piping systems, including vent masts and headers, are to be examined
- cargo pump rooms and pipe tunnels, if fitted, are to be examined.

39 NOISE-PORT-OUT(X) and NOISE-PORT-IN(X)

39.1 Renewal survey

39.1.1 *(1/1/2023)*

Verification that the ship has not been subjected to modifications, refitting or major repairs that may affect its level of emitted noise during port operations.

In particular, the following items have to be verified:

- auxiliary engine(s)
- air-conditioning system(s) and ventilation system(s), including their intake and delivery ducts or plenum.

40 COATING PERFORMANCE STANDARD IN CARGO OIL TANKS (CPS-COT)

40.1 General

40.1.1 *(1/1/2023)*

For the additional class notation **CPS-COT** to be retained during the lifetime of the crude oil tanker, the protective coatings are to be checked by the Society during the examination of the cargo oil tanks at class surveys and their condition is to be assessed as GOOD, as per the definition given in Ch 2, Sec 2, [2.2.13].

The scope of the coating examination during intermediate and class renewal surveys is laid down in [40.2].

In addition, the Owner is to notify the Society of any damage to the protective coatings, as laid down in [40.3].

40.2 Intermediate and class renewal surveys

40.2.1 Scope *(1/1/2023)*

The protective coatings of all cargo oil tanks subject to examination at intermediate and class renewal surveys are to be checked.

The condition of the coating in tanks is to be evaluated and recorded as "GOOD", "FAIR", or "POOR" based on visual inspection and estimated percentage of areas with coating failure and rusty surfaces.

When the coating is found to be in less than GOOD condition, as defined in Ch 2, Sec 2, [2.2.13], the Owner is to carry out those repairs as required by the attending Surveyor to restore the coating condition to GOOD at the intermediate or class renewal surveys. Failure to carry out the above repairs will result in suspension of the additional class notation **CPS-COT**.

40.2.2 Frequency of inspections *(1/1/2023)*

The coating system in cargo tanks is to be examined at:

- special surveys; and
- intermediate surveys for tankers of 10 years of age and above.

40.3 Coating damage and repairs

40.3.1 *(1/1/2023)*

The Owner is to keep records and inform the attending Surveyor at the first subsequent attendance on board about any damage to the protective coatings which has been found and left for further inspection or already repaired since the date of first classification or last intermediate or class renewal survey, as applicable. However, where the nature and/or extent of damage to the coating is significant, the Owner is to inform the Society for the attendance of a Surveyor before repairs are carried out.

40.3.2 *(1/1/2023)*

Coating is to be repaired in accordance with the paint Manufacturer's recommendations.

The attending Surveyor is to check that damage to the coating has been properly repaired according to the technical specifications and that it has been restored to GOOD condition; this may be done during the intermediate or class renewal survey, or during an occasional survey, upon the Owner's request or subject to the decision of the Society.

41 DIGITAL SHIP (D)

41.1 Annual and Renewal Surveys

41.1.1 *(1/1/2023)*

To maintain the additional class notation **DIGITAL SHIP (D)**, the software included in the document "List of the software applications covered by the notation" (to be submitted for information for the assignment of the notation) is to be assessed periodically (yearly), found in good working conditions and capable of transferring data ashore when applicable.

Depending on the electronic system/digital tool, the assessment activity can be carried out completely or partially remotely (e.g. without a visit on board) based on the possibility to collect the requested evidences.

For the purpose of the periodical assessment, access to the electronic system/digital tool is to be granted to the Society's surveyors.

Action logs performed during the periodical assessment activities are to be recorded and stored to have the traceability history of the activity.

Any modification to the system and the software release are to be previously communicated to the Society and properly recorded.

Hardware update or update/upgrade of software versions are to be reapproved unless there is documented evidence that the modification does not affect the capability of the system to collect, manage, store and, when applicable, transfer the data ashore.

42 FUEL SAMPLING

42.1 Annual and renewal survey

42.1.1 *(1/1/2023)*

The approved diagram of fuel oil system (Pt C, Ch 1, Sec 10, Tab 1) showing the sampling points location is to be presented to the surveyor during surveys.

The annual and renewal surveys are to include:

- check that the positions of the sampling points correspond to the ones shown in the approved diagram of fuel oil system
- verification of tightness of sampling equipment (e.g. valve, cock, plug).

SECTION 5 SEA PRESSURES

Symbols

For the symbols not defined in this Section, refer to the list at the beginning of this Chapter.

ρ : Sea water density, taken equal to 1,025 t/m^3

h_1 : Reference values of the ship relative motions in the upright ship condition, defined in Sec 3, [3.3]

h_2 : Reference values of the ship relative motions in the inclined ship conditions, defined in Sec 3, [3.3].

1 Still water pressure

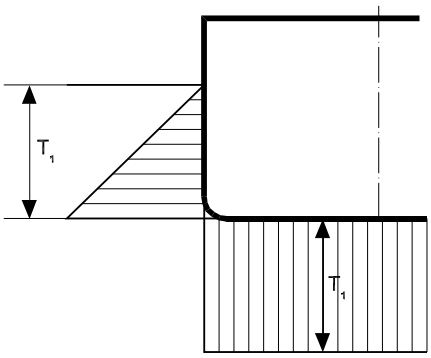
1.1 Pressure on sides and bottom

1.1.1 The still water pressure at any point of the hull is obtained from the formulae in Tab 1 (see also Fig 1).

Table 1 : Still water pressure

Location	Still water pressure p_S, in kN/m^2
Points at and below the waterline ($z \leq T_1$)	$\rho g(T_1 - z)$
Points above the waterline ($z > T_1$)	0

Figure 1 : Still water pressure



1.2 ~~Pressure on e~~Exposed decks

1.2.1 Application *(1/1/2023)*

The still water and wave sea pressures defined in [1.2.2] and [2.1.2] for exposed decks are to be considered independently of the pressures due to dry uniform cargoes, dry unit cargoes or wheeled cargoes, if any, as defined in Sec 6, [4], Sec 6, [5] and Sec 6, [6] respectively.

~~On exposed decks, the pressure due to the load carried is to be considered. This pressure is to be defined by the Designer and, in general, it may not be taken less than 10φ kN/m^2, where φ is defined in Tab 2.~~

~~The Society may accept pressure values lower than 10φ kN/m^2, when considered appropriate on the basis of the intended use of the deck.~~

1.2.2 Still water pressure on exposed decks *(1/1/2023)*

The still water pressure on exposed decks is to be taken equal to 10·φ, where φ is defined in Tab 2.

Table 2 : Coefficient for pressure on exposed decks *(1/7/2011)*

Exposed deck location	φ
Freeboard deck	1,00
Superstructure deck	0,75
1st tier of deckhouse	0,56
2nd tier of deckhouse	0,42
3rd tier of deckhouse	0,32
4th tier of deckhouse	0,25
5th tier of deckhouse	0,20
6th tier of deckhouse	0,15
7th tier of deckhouse and above	0,10

2 Wave pressure

2.1 Upright ship conditions (Load cases “a” and “b”)

2.1.1 Pressure on sides and bottom

The wave pressure at any point of the hull is obtained from the formulae in Tab 3 (see also Fig 2 for load case “a” and Fig 3 for load case “b”).

SECTION 1 DESIGN LOADS

Symbols

For symbols not defined in this Section, refer to the list at the beginning of this Chapter.

n, n_1 : Navigation coefficients, defined in [1.5]

C : Wave parameter:

$$C = (118 - 0,36L)\frac{L}{1000}$$

F : Froude's number:

$$F = 0,164\frac{V}{\sqrt{L}}$$

V : Contractual service speed, in knots

a_B : Motion and acceleration parameter:

$$a_B = n\left(0,76F + 1,875\frac{h_W}{L}\right)$$

h_W : Wave parameter, in m:

$$h_W = 11,44 - \left|\frac{L - 250}{110}\right|^3$$

h_1 : Reference value of the ship relative motion, in m, defined in [3.3.1]

a_{X1}, a_{Z1} : Reference values of the accelerations, in m/s^2, defined in [3.3.2].

1 General

1.1 Definitions

1.1.1 Still water loads

Still water loads are those acting on the ship at rest in calm water.

1.1.2 Wave loads

Wave loads are those due to wave pressures and ship motions, which can be assumed to have the same period as the inducing waves.

1.1.3 Local loads

Local loads are pressures and forces which are directly applied to the individual structural members: plating panels, ordinary stiffeners and primary supporting members.

- Still water local loads are constituted by the hydrostatic external sea pressures and the static pressures and forces induced by the weights carried in the ship spaces.
- Wave local loads are constituted by the external sea pressures due to waves and the inertial pressures and forces induced by the ship accelerations applied to the weights carried in the ship spaces.

For the structures which form the boundary of spaces not intended to carry liquids and which do not belong to the outer shell, the still water and wave pressures in flooding conditions are also to be considered.

1.1.4 Hull girder loads

Hull girder loads are still water and wave bending moments which result as effects of local loads acting on the ship as a whole and considered as a girder.

1.1.5 Loading condition

A loading condition is a distribution of weights carried in the ship spaces arranged for their storage.

1.1.6 Load case

A load case is a state of the ship structures subjected to a combination of hull girder and local loads.

1.2 Application criteria

1.2.1 Requirements applicable to all types of ships

The still water and wave loads defined in this Section are to be used for the determination of the hull girder strength and structural scantlings in the central part (see Ch 1, Sec 1) of ships less than 90 m in length, according to the requirements in Sec 2, Sec 3, Sec 4 and Sec 5.

1.2.2 Requirements applicable to specific ship types

The design loads applicable to specific ship types are to be defined in accordance with the requirements in Part E.

1.3 Hull girder loads

1.3.1 The still water and wave bending moment to be used for the determination of:

- the hull girder strength, according to the requirements of Sec 2
- the structural scantling of plating, ordinary stiffeners and primary supporting members contributing to the hull girder strength, in combination with the local loads given in [4] and [5], according to the requirements in Sec 3, Sec 4 and Sec 5,

are specified in [2].

1.4 Local loads

1.4.1 General

The local loads defined in [1.1.3] are to be calculated as specified in [1.4.2] for the elements of the outer shell and in [1.4.3] for the other elements.

3.3 Ship relative motion and accelerations

3.3.1 Ship relative motion

The ship relative motion is the vertical oscillating translation of the sea waterline on the ship side. It is measured, with its sign, from the waterline at draught T and can be assumed as being symmetrical on the ship sides.

The reference value of the relative motion is obtained, at any hull transverse section, from the formulae in Tab 4.

3.3.2 Accelerations

The accelerations in X and Z direction are the acceleration components which result from the ship motions defined in [3.2]. Their reference values at any point are obtained from the formulae in Tab 5.

4 Sea pressures

4.1 Still water and wave pressures

4.1.1 The still water and wave pressures are obtained, in kN/m^2, as specified in Tab 6 (see also Fig 2).

4.2 Exposed decks

4.2.1 Application *(1/1/2023)*

The still water and wave sea pressures defined in Tab 6 for exposed decks are to be considered independently of the pressures due to dry uniform cargoes, dry unit cargoes or wheeled cargoes, if any, as defined in [5.3], [5.4] and [5.5] respectively.

5 Internal pressures and forces

5.1 Liquids

5.1.1 Still water and inertial pressures

The still water and inertial pressures are obtained, in kN/m^2, as specified in Tab ~~8~~7.

Table 6 : Still water and wave pressures *(1/1/2023)*

Location	Still water pressure p_S, in kN/m^2	Wave pressure p_W, in kN/m^2
Bottom and side below the waterline $z \le T$	$\rho g(T - z)$	$\rho g h_1 e^{\frac{-2\pi(T-z)}{L}}$
Side above the waterline $z > T$	0	$\rho g(T + h_1 - z)$ without being taken less than 0,15L
Exposed decks	10φ kN/m^2 ~~Pressure due to the load carried (1)~~	$17,5\,n\varphi$ for $0 \le x \le 0,5L$ $\left\{17,5 + \left[\frac{19,6\sqrt{H_F} - 17,5}{0,25}\right]\left(\frac{x}{L} - 0,5\right)\right\} n\varphi$ for $0,5L < x < 0,75L$ $19,6\,n\varphi\sqrt{H}$ for $0,75L \le x \le L$

(1) ~~The pressure due to the load carried is to be defined by the Designer and, in general, it may not be taken less than 10φ kN/m^2, where φ is defined in Tab 7.~~

~~The Society may accept pressure values lower than 10φ kN/m^2 when considered appropriate on the basis of the intended use of the deck.~~

Note 1:

ρ : Sea water density, in t/m^3:
ρ = 1,025 t/m^3,

H_F : Value of H calculated at x = 0,75L

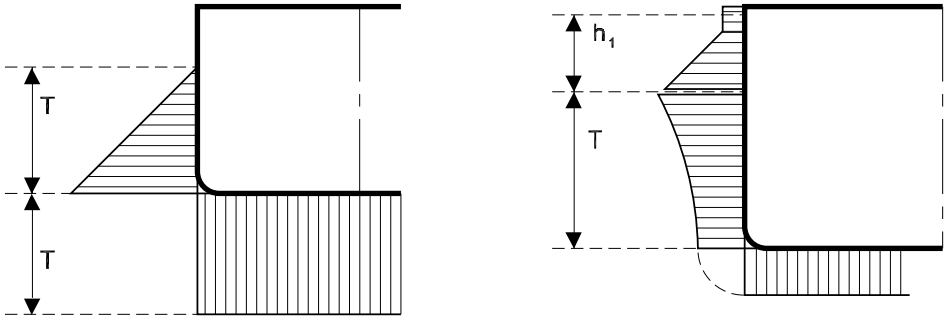
V : Contractual service speed, in knots, to be taken not less than 13 knots

φ : Defined in Ch 5, Sec 5, Tab ~~7~~2.

$$H = \left[2,66\left(\frac{x}{L} - 0,7\right)^2 + 0,14\right]\sqrt{\frac{VL}{C_B}} - (z - T)$$

without being taken less than 0,8,

Figure 2 : Still water and wave pressures



Still water pressure

Wave pressure

Table 7 : ~~Coefficient for pressure on exposed decks~~

~~Exposed deck location~~	~~φ~~
~~Freeboard deck~~	~~1,00~~
~~Superstructure deck~~	~~0,75~~
~~1st tier of deckhouse~~	~~0,56~~
~~2nd tier of deckhouse and above~~	~~0,42~~

5.2 Dry bulk cargoes

5.2.1 Still water and inertial pressures

The still water and inertial pressures (excluding those acting on the sloping plates of wing tanks, which may be taken equal to zero) are obtained, in kN/m^2, as specified in Tab ~~9~~8.

5.3 Dry uniform cargoes

5.3.1 Still water and inertial pressures

In ships with two or more decks, the pressure transmitted to the deck structures by the dry uniform cargoes in cargo compartments is to be considered.

The still water and inertial pressures transmitted to the deck structures are obtained, in kN/m^2, as specified in Tab ~~10~~9.

Table 8 : Liquids
Still water and wave pressures

Still water pressure p_S, in kN/m^2	Inertial pressure p_W, in kN/m^2
The greater of the values obtained from the following formulae: $\rho_L g(z_L - z)$ $\rho_L g(z_{TOP} - z) + 100 p_{PV}$ to be taken not less than: $\rho_L g\left(\frac{0,8 L_1}{420 - L_1}\right)$	$\rho_L \left[a_{X1} \frac{\ell_C}{2} + a_{Z1}(z_{TOP} - z) \right]$

Note 1:

ρ_L : Density, in t/m^3, of the liquid cargo carried

z_{TOP} : Z co-ordinate, in m, of the highest point of the tank in the z direction

z_L : Z co-ordinate, in m, of the highest point of the liquid:

$$z_L = z_{TOP} + 0,5(z_{AP} - z_{TOP})$$

z_{AP} : Z co-ordinate, in m, of the moulded deck line of the deck to which the air pipes extend, to be taken not less than z_{TOP}

p_{PV} : Setting pressure, in bar, of safety valves

ℓ_C : Longitudinal distance, in m, between the transverse tank boundaries.

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SECTION 7 HATCH COVERS, HATCH COAMINGS AND CLOSING DEVICES

Symbols

T_{fb} : the least moulded depth, in m, as defined according to Regulation 3 of the International Load Line Convention 1966, as amended.

h_n : standard superstructure height, in m:

- $h_n = 1,05 + 0,01\ L_{LL}$
- $h_n = 1,8 \leq h_n \leq 2,3$

A_{Sh} : Net shear sectional area, in cm^2, of the ordinary stiffener or primary supporting member, to be calculated as specified in Ch 4, Sec 3, [3.4], for ordinary stiffeners, and Ch 4, Sec 3, [4.3], for primary supporting members

t_C : Corrosion additions, in mm, defined in [1.4]

k : Material factor, defined in Ch 4, Sec 1, [2.3]

a_V : Vertical acceleration according to [3.3.1]

g : Gravity acceleration, in m/s^2:

$g = 9,81\ m/s^2$.

1 General

1.1 Application

1.1.1 *(1/7/2019)*

The requirements in [1] to [8] apply to steel hatch covers in positions 1 and 2 on weather decks, defined in Ch 1, Sec 2, [3.16] for all ship types, except ships for which one of the following service notation is assigned:

- **bulk carrier**
- **self-unloading bulk carrier**
- **ore carrier**
- **combination carrier**

for which the specific requirements of Part E apply.

The requirements in [9] apply to steel covers of small hatches fitted on the exposed fore deck over the forward 0,25L.

1.2 Materials

1.2.1 Steel *(1/7/2016)*

Material class I is to be applied for top plate, bottom plate and primary supporting members.

The formulae for scantlings given in the requirements in [4] are applicable to steel.

Materials used for the construction of steel hatch covers are to comply with the applicable requirements of Part D, Chapter 2.

1.2.2 Other materials *(1/7/2012)*

The use of materials other than steel is considered by the Society on a case by case basis, by checking that criteria adopted for scantlings are such as to ensure strength and stiffness equivalent to those of steel hatch covers.

1.3 Net scantlings

1.3.1 *(1/7/2016)*

As specified in Ch 4, Sec 2, [1], unless otherwise specified all scantlings referred to in this Section are net, i.e. they do not include any margin for corrosion.

Strength calculations using grillage analysis or FEM are to be performed with net scantlings.

The gross scantlings are obtained as specified in Ch 4, Sec 2.

1.4 Corrosion additions

1.4.1 Corrosion additions for hatch covers *(1/7/2012)*

The corrosion addition to be considered for the plating and internal members of hatch covers is the value specified in Tab 1 for the total thickness of the member under consideration.

1.4.2 Corrosion additions for hatch coamings *(1/7/2012)*

The corrosion addition to be considered for the hatch coaming structures and coaming stays is equal to 1,5 mm.

2.3 Hatch coamings

2.3.1 *(1/7/2012)*

Coamings, stiffeners and brackets are to be capable of withstanding the local forces in way of the clamping devices and handling facilities necessary for securing and moving the hatch covers as well as those due to cargo stowed on the latter.

2.3.2 *(1/7/2012)*

Special attention is to be paid to the strength of the fore transverse coaming of the forward hatch and to the scantlings of the closing devices of the hatch cover on this coaming.

2.3.3 *(1/7/2012)*

Longitudinal coamings are to be extended at least to the lower edge of deck beams.

Where they are not part of continuous deck girders, longitudinal coamings are to extend for at least two frame spaces beyond the end of the openings.

Where longitudinal coamings are part of deck girders, their scantlings are to be as required in Ch 7, Sec 3.

2.3.4 *(1/7/2012)*

Transverse coamings are to extend below the deck at least to the lower edge of longitudinals.

Transverse coamings not in line with ordinary deck beams below are to extend below the deck at least three longitudinal frame spaces beyond the side coamings.

2.3.5 *(1/7/2012)*

Secondary stiffeners of hatch coamings are to be continuous over the breadth and length of hatch coamings.

2.4 Small hatchways

2.4.1 *(1/7/2012)*

The height of small hatchway coamings is to be not less than 600 mm if located in position 1, and 450 mm if located in position 2.

Where the closing appliances are in the form of hinged steel covers secured weathertight by gaskets and swing bolts, the height of the coamings may be reduced or the coamings may be omitted altogether.

2.4.2 *(1/7/2012)*

Small hatch covers are to have strength equivalent to that required for main hatchways and are to be of steel, weathertight and generally hinged.

Securing arrangements and stiffening of hatch cover edges are to be such that weathertightness can be maintained in any sea condition.

At least one securing device is to be fitted at each side. Circular hole hinges are considered equivalent to securing devices.

2.4.3 *(1/7/2012)*

Hold accesses located on the weather deck are to be provided with watertight metallic hatch covers, unless they are protected by a closed superstructure. The same applies to accesses located on the forecastle deck and leading directly to a dry cargo hold through a trunk.

2.4.4 *(1/7/2012)*

Accesses to cofferdams and ballast tanks are to be manholes fitted with watertight covers fixed with bolts which are sufficiently closely spaced.

2.4.5 *(1/7/2012)*

Hatchways of special design are considered by the Society on a case by case basis.

3 Hatch cover and coaming load model

3.1 Vertical weather design load

3.1.1 Pressure *(1/7/2012)*

The pressure p_H, in kN/m^2, on the hatch cover panels is given in Tab 2. The vertical weather design load needs not to be combined with cargo loads according to [3.3] and [3.4].

In Fig 1 the positions 1 and 2 are illustrated for an example ship.

Where an increased freeboard is assigned, the design load for hatch covers according to Tab 2 on the actual freeboard deck may be as required for a superstructure deck, provided the summer freeboard is such that the resulting draught will not be greater than that corresponding to the minimum freeboard calculated from an assumed freeboard deck situated at a distance at least equal to the standard superstructure height h_N below the actual freeboard deck, see Fig 2.

$c_L = 1$ for $L \geq 90$ m

$a = 20 + L_1/12$, for unprotected front coamings and hatch cover skirt plates

$a = 10 + L_1/12$, for unprotected front coamings and hatch cover skirt plates, where the distance from the actual freeboard deck to the summer load line exceeds the minimum non-corrected tabular freeboard according to the IMO International Load Lines (ICLL) by at least one standard superstructure height h_N.

$a = 5 + L_1/15$, for side and protected front coamings and hatch cover skirt plates

$a = 7 + L_1/100 - 8 \cdot x' / L$, for aft ends of coamings and aft hatch cover skirt plates abaft amidships

$a = 5 + L_1/100 - 4 \cdot x' / L$, for aft ends of coamings and aft hatch cover skirt plates forward of amidships

L_1 : L, need not be taken greater than 300 m

$$b = 1,0 + \left(\frac{\frac{x'}{L} - 0,45}{C_B + 0,2} \right)^2 \text{ for } \frac{x'}{L} < 0,45$$

$$b = 1,0 + 1,5 \cdot \left(\frac{\frac{x'}{L} - 0,45}{C_B + 0,2} \right)^2 \text{ for } \frac{x'}{L} \geq 0,45$$

$0,6 \leq C_B \leq 0,8$, when determining scantlings of aft ends of coamings and aft hatch cover skirt plates forward of amidships, C_B need not be taken less than 0,8.

x′ : distance in m between the transverse coaming or hatch cover skirt plate considered and aft end of the length L. When determining side coamings or side hatch cover skirt plates, the side is to be subdivided into parts of approximately equal length, not exceeding 0,15 L each, and x' is to be taken as the distance between aft end of the length L and the centre of each part considered

z : vertical distance in m from the summer load line to the midpoint of stiffener span, or to the middle of the plate field

c : $0,3 + 0,7 \cdot (b'/B')$

b′ : breadth of coaming in m at the position considered

B′ : actual maximum breadth of ship in m on the exposed weather deck at the position considered

b'/B' is not to be taken less than 0,25.

The design load p_A is not to be taken less than the minimum values given in Tab 3.

Table 3 : Minimum design load p_{Amin} *(1/7/2012)*

L	p_{Amin} in kN/m² for	
	unprotected fronts	elsewhere
≤ 50	30	15
> 50 < 250	25 + L / 10	12,5 + L / 20
≥ 250	50	25

Note 1: The horizontal weather design load need not be included in the direct strength calculation of the hatch cover, unless it is utilized for the design of substructures of horizontal support according to [7.2.3].

3.3 Cargo loads

3.3.1 Distributed loads *(1/7/2016)*

The load on hatch covers due to distributed cargo loads p_L, in kN/m², resulting from heave and pitch (i.e. ship is upright condition) is to be determined according to the following formula:

$p_L = p_C (1 + a_v)$

p_C : uniform cargo load, in kN/m²

a_v : vertical acceleration addition as follows

$a_v = F \cdot m$

$$F = 0,11 \cdot \frac{v_0}{\sqrt{L}}$$

$$m = m_0 - 5(m_0 - 1) \cdot \frac{x}{L} \text{ for } 0 \leq \frac{x}{L} \leq 0,2$$

$$m = 1,0 \text{ for } 0,2 < \frac{x}{L} \leq 0,7$$

$$m = 1 + \frac{m_0 + 1}{0,3} \cdot \left[\frac{x}{L} - 0,7 \right] \text{ for } 0,7 < \frac{x}{L} \leq 1,0$$

$m_0 = 1,5 + F$

v_0 = maximum speed at number load line draught, v_0 is not to be taken less than $\sqrt{L}$ in knots

3.3.2 Point loads *(1/7/2016)*

The load P, in kN, due to a concentrated forces P_S, in kN, except for container load, resulting from heave and pitch (i.e. in upright condition) is to be determined as follows:

$P = P_S (1 + a_v)$

P_S = single force in kN

3.4 Container loads

3.43.13 General *(1/7/2016)*

The loads defined in [3.34.2] and [3.43.34] are to be applied where containers are stowed on the hatch cover.

3.43.24 *(1/7/2016)*

The load in kN, applied at each corner of a container stack, and resulting from heave and pitch (i.e. ship in upright condition) is to be determined as follows:

$$P = 9,81\frac{M}{4}(1 + a_v)$$

where:

a_v = acceleration addition according to [2.3.1]

M = maximum designed mass of container stack in t

3.4 ~~Container loads~~

3.4.31 ~~General~~ *(1/7/2016)*

The following loads in kN due to heave, pitch, and the ship's rolling motion are to be considered, see also Fig 3.

$$A_Z = 9,81\frac{M}{2} \cdot (1 + a_v) \cdot \left(0,45 - 0,42\frac{h_m}{b}\right)$$

$$B_Z = 9,81\frac{M}{2} \cdot (1 + a_v) \cdot \left(0,45 + 0,42\frac{h_m}{b}\right)$$

$B_y = 2,4 \cdot M$

a_v : acceleration addition according to [3.3.1]

M : maximum designed mass of container stack, in t

h_m : designed height of centre of gravity of stack above hatch cover top in m, may be calculated as weighted mean value of the stack, where the centre of gravity of each tier is assumed to be located at the centre of each container:

$$= \sum(z_i \cdot W_i)/M$$

z_i : distance from hatch cover top to the centre of ith container in m.

W_i : weight of /th container in t

b : distance between midpoints of foot points, in m

A_Z, B_Z : support forces in z-direction at the forward and aft stack corners

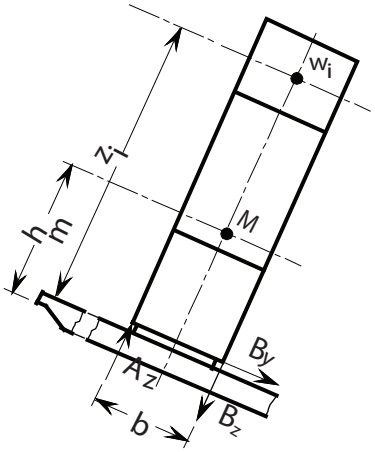
B_Y : support force in y-direction at the forward and aft stack corners.

When strength of the hatch cover structure is assessed by grillage analysis according to 3,5, h_m and z_i need to be taken above the hatch cover supports. Forces By does not need to be considered in this case.

Values of A_Z and B_Z applied for the assessment of hatch cover strength are to be shown in the drawings of the hatch covers.

Note 1: It is recommended that container loads as calculated above are considered as limit for foot point loads of container stacks in the calculations of cargo securing (container lashing).

Figure 3 : Forces due to container loads *(1/7/2016)*



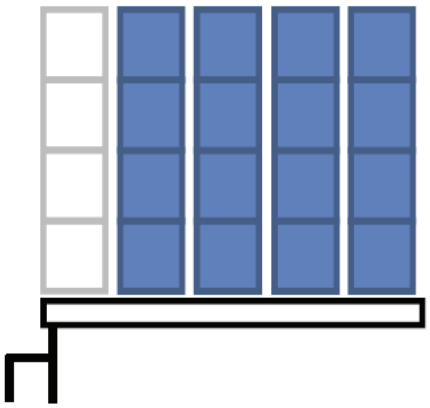
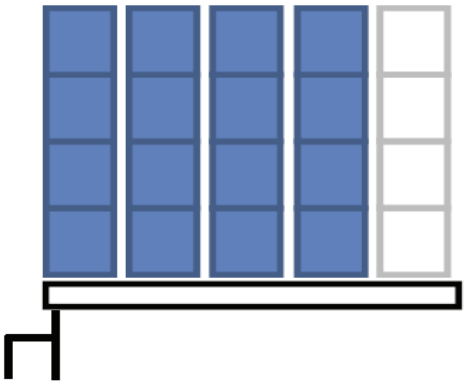
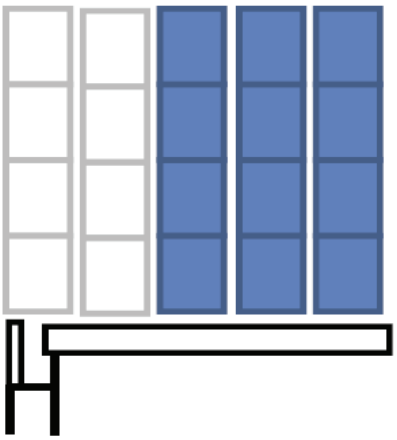
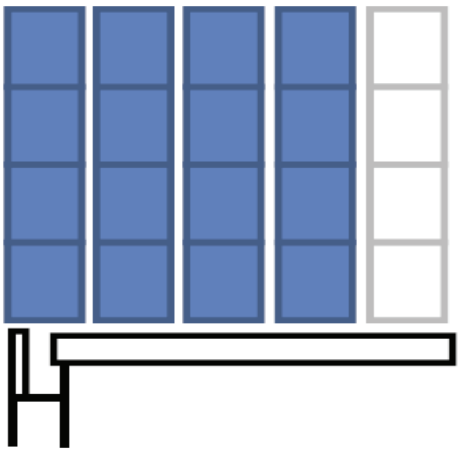
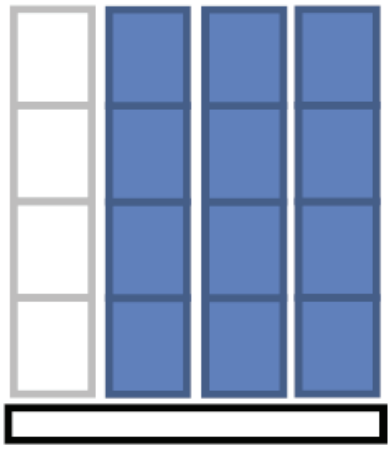
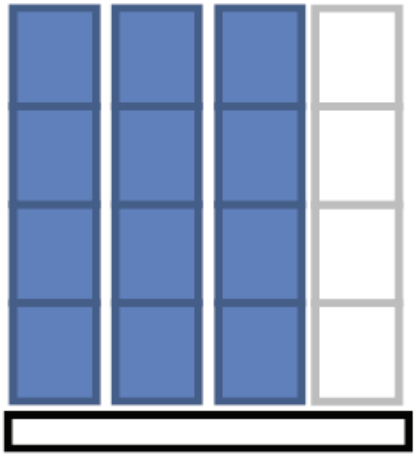
3.4.42 Load cases with partial loading *(1/7/2016)*

The load defined in cases [3.3] and [3.4] are also to be considered for partial non homogeneous loading which may occur in practice, e.g. where specified container stack places are empty. For each hatch cover, the heel directions, as shown in Tab 3, are to be considered

The load case partial loading of container hatch covers can be evaluated using a simplified approach, where the hatch cover is loaded without the outermost stacks, see that are located completely on the hatch cover. If there are additional stacks that are supported partially by the hatch cover and partially by container stanchions then the loads from these stacks are also to be neglected, refer to Tab 3. In addition, the case where only the stack places supported partially by the hatch cover and partially by container stanchions are left empty is to be assessed in order to consider the maximum loads in the vertical hatch cover supports.

It may be necessary to also consider partial load cases where more or different container stack places are left empty. Partial load case should in general be considered.

Table 4 : Partial loading of container hatch covers *(1/7/2016)*

Heel direction	◁----------	----------▷
Hatch covers supported by the longitudinal hatch coaming with all container stacks located completely on the hatch cover		
Hatch covers supported by the longitudinal hatch coaming with the outermost container stack supported partially by the hatch cover and partially by container stanchions		
Hatch covers not supported by the longitudinal hatch coaming (center hatch covers)		

3.4.5~~3~~ Mixed stowage of 20' and 40' containers on hatch cover *(1/7/2016)*

In the case of mixed stowage (20'+40' container combined stack), the foot point forces at the fore and aft end of the hatch cover are not to be higher than resulting from the design stack weight for 40' containers, and the foot point forces at the middle of the cover are not to be higher than resulting from the design stack weight for 20' containers.

SECTION 4 EQUIPMENT

Symbols

EN : Equipment Number defined in [2.1],

σ_{ALL} : allowable stress, in N/mm^2, used for the yielding check in [4.9.7], [4.10.7], [4.11.2] and [4.11.3], to be taken as the lesser of:

- $\sigma_{ALL} = 0,67\ R_{eH}$
- $\sigma_{ALL} = 0,40\ R_m$

R_{eH} : minimum yield stress, in N/mm^2, of the material, defined in Ch 4, Sec 1, [2]

R_m : tensile strength, in N/mm^2, of the material, defined in Ch 4, Sec 1, [2].

1 General

1.1 General

1.1.1 The requirements in [2] to [4] apply to temporary mooring of a ship within or near harbour, or in a sheltered area, when the ship is awaiting a berth, the tide, etc.

Therefore, the equipment complying with the requirements in [2] to [4] is not intended for holding a ship off fully exposed coasts in rough weather or for stopping a ship which is moving or drifting.

1.1.2 The equipment complying with the requirements in [2] to [4] is intended for holding a ship in good holding ground, where the conditions are such as to avoid dragging of the anchor. In poor holding ground the holding power of the anchors is to be significantly reduced.

1.1.3 It is assumed that under normal circumstances a ship will use one anchor only.

1.2 Definitions

1.2.1 Nominal capacity condition *(1/1/2022)*

Nominal capacity condition is the theoretical condition where the maximum possible deck cargoes are included in the ship arrangement in their respective positions. For container ships the nominal capacity condition represents the theoretical condition where the maximum possible number of containers is included in the ship arrangement in their respective positions.

1.2.2 Ship Design Minimum Breaking Load (MBL_{SD}) *(1/1/2022)*

Ship Design Minimum Breaking Load is the minimum breaking load of new, dry mooring lines or tow line for which shipboard fittings and supporting hull structures are designed in order to meet mooring restraint requirements or the towing requirements of other towing service.

1.2.3 Line Design Break Force (LDBF) (1/1/2022)

Line Design Break Force is the minimum force that a new, dry, spliced, mooring line will break at. This is for all synthetic cordage materials.

2 Equipment number

2.1 Equipment number

2.1.1 General *(1/7/2014)*

All ships are to be provided with equipment in anchors and chain cables (or ropes according to [3.3.5]), to be obtained from Tab 1, based on their Equipment Number EN.

In general, stockless anchors are to be adopted.

For ships with EN greater than 16000, the determination of the equipment will be considered by the Society on a case by case basis.

For ships having the navigation notation **coastal area** or **sheltered area**, the equipment in anchors and chain cables may be reduced. The reduction consists of entering Tab 1 one line higher for ships having the navigation notation **coastal area** and two lines higher for ships having the navigation notation **sheltered area**, based on their Equipment Number EN.

For ships of special design or ships engaged in special services or on special voyages, the Society may consider equipment other than that in Tab 1.

2.1.2 Equipment Number for ships with perpendicular superstructure front bulkhead *(1/1/2022)*

The Equipment Number EN is to be obtained from the following formula:

$$EN = \Delta^{2/3} + 2(h\ B + S_{fun}) + 0,1\ A$$

where:

Δ : moulded displacement of the ship, in t, to the summer load waterline,

h : effective height, in m, from the summer load waterline to the top of the uppermost house, to be obtained in accordance with the following formula:

$h = a + \Sigma h_n$

When calculating h, sheer and trim are to be ignored (i.e. h is the sum of freeboard amidships plus the height (at centreline) of each tier of houses having a breadth greater than B/4),

a : vertical distance at side hull, in m, from the summer load waterline amidships to the upper deck,

h_n : height, in m, at the centreline of tier "n" of superstructures or deckhouses having a breadth

Equipment number EN A < EN ≤ B		Stockless anchors		Stud link chain cables for anchors			
		N	Mass per anchor, in kg	Total length, in m	Diameter, in mm		
A	B				Q1	Q2	Q3
10000	10700	2	31000	770,0			137,0
10700	11500	2	33000	770,0			142,0
11500	12400	2	35500	770,0			147,0
12400	13400	2	38500	770,0			152,0
13400	14600	2	42000	770,0			157,0
14600	16000	2	46000	770,0			162,0

2.1.3 Equipment Number for ships with inclined superstructure front bulkhead *(1/1/2022)*

For ships with navigation notation other than unrestricted navigation and having superstructures with the front bulkhead with an angle of inclination aft, the Equipment Number EN is to be obtained from the following formula:

$$EN = \Delta^{2/3} + 2\,(a\,B + \Sigma b_N\,h_N \sin\theta_N + S_{fun}) + 0{,}1\,A$$

where:

Δ, a, h_N, A and S_{fun}:as defined in [2.1.2],

θ_N : angle of inclination aft of each front bulkhead, shown in Fig 8,

b_N : greatest breadth, in m, of each tier n of superstructures or deckhouses having a breadth greater than B/4.

Fixed screens or bulwarks 1,5 m or more in height are to be regarded as parts of houses when determining h and A. In particular, the hatched area shown in Fig 8 is to be included.

3 Equipment

3.1 Shipboard fittings and supporting hull structures

3.1.1 Application *(1/7/2018)*

Ships are to be provided with arrangements, equipment and fittings of sufficient safe working load to enable the safe conduct of all towing and mooring operations associated with the normal operations of the ship.

The requirements of [3.1] apply to ships of 500 gross tonnage and upwards; in particular they apply to bollards, bitts, fairleads, stand rollers, chocks used for normal mooring of the ship and similar components used for normal towing of the ship. For emergency towing arrangements, the requirements in [4] are to be applied. Normal towing means towing operations necessary for manoeuvring in ports and sheltered waters associated with the normal operations of the ship.

For ships, not subject to Regulation 3-4 of Chapter II-1 of SOLAS Convention, but intended to be fitted with equipment for towing by another ship or a tug, the requirements designated as 'other towing' are to be applied to design and construction of those shipboard fittings and supporting hull structures.

Requirements of [3.1] is not applicable to design and construction of shipboard fittings and supporting hull structures used for special towing services defined as:

- Escort towing: Towing service, in particular for laden oil tankers or LNG carriers, required in specific estuaries. Its main purpose is to control the ship in case of failures of the propulsion or steering system. It should be referred to local escort requirements and guidance given by, e.g., the Oil Companies International Marine Forum (OCIMF); for the requirements of shipboard fittings and supporting hull structures of ships with service notation **escort tug** , see Pt E, Ch 14, [2] and [4].
- Canal transit towing: Towing service for ships transiting canals, e.g. the Panama Canal. It should be referred to local canal transit requirements.
- Emergency towing for tankers: Towing services to assist tankers in case of emergency. For emergency towing arrangements of ships which are to comply with Regulation 3-4 of Chapter II-1 of SOLAS Convention, the requirements in [4] are to be applied.

The supporting hull structures are constituted by that part of the ship's structure on/in which the shipboard fitting is placed and which is directly submitted to the forces exerted on the shipboard fitting. The supporting hull structures of capstans, winches, etc used for normal or other towing and mooring operations are also covered by [3.1].

Other components such as capstans, winches, etc are not covered by this item. Any weld or bolt or equivalent device connecting the shipboard fitting to the supporting structure is part of the shipboard fitting and if selected from an industry standards subject to that standard applicable to this shipboard fitting.

3.1.2 Net scantlings *(1/1/2007)*

The net minimum scantlings of the supporting hull structure are to comply with the requirements in [3.1.9] and [3.1.15]. The net thicknesses, t_{net}, are the member thicknesses necessary to obtain the above required minimum net scantlings. The required gross thicknesses are obtained by adding the total corrosion additions, t_c, given in [3.1.3], to t_{net}.

3.1.3 Corrosion addition *(1/1/2022)*

The total corrosion addition, t_c, in mm, is not to be less than the following values:

a) Ships covered by Common Structural Rules for Bulk Carriers and Oil Tankers:

t_C:, total corrosion addition to be as defined in these rules.

Table 6 : Additional mooring lines

A/EN	Number of additional mooring lines
0,9 < A/EN ≤ 1,1	1
1,1 < A/EN ≤ 1,2	2
1,2 < A/EN	3
Note 1: A and EN are defined in [2.1.2].	

3.6.2 In order to obtain an easy lead of the chain cables, the hawse pipes may be provided with rollers. These rollers are to have a nominal diameter not less than 10 times the size of the chain cable where they are provided with full imprints, and not less than 12 times its size where provided with partial imprints only.

3.6.3 All mooring units and accessories, such as thimble, riding and trip stoppers are to be securely fastened to the Surveyor's satisfaction.

3.7 Windlass

3.7.1 General *(1/7/2018)*

The windlass, which is generally single, is to be power driven and suitable for the size of chain cable and the mass of the anchors. Windlass is also to comply with requirements given in Pt C, Ch 1, Sec 15.

In mechanically propelled ships of less than 200 t gross tonnage, a hand-operated windlass may be fitted. In such case it is to be so designed as to be capable of weighing the anchors in a reasonably short time.

The windlass is to be fitted in a suitable position in order to ensure an easy lead of the chain cables to and through the hawse pipes. The deck in way of the windlass is to be suitably reinforced.

3.7.2 Windlass brake *(1/7/2018)*

A windlass brake is to be provided having sufficient capacity to stop the anchor and chain cable when paying out the latter with safety, in the event of failure of the power supply to the prime mover. Windlasses not actuated by steam are also to be provided with a non-return device.

Where a chain cable stopper is fitted, a windlass with brakes applied and the cable lifter declutched is to be able to withstand a pull of 45% of the breaking load of the chain without any permanent deformation of the stressed parts or brake slip.

Where a chain stopper is not fitted a windlass with brakes applied and the cable lifter declutched is to be able to withstand a pull of 80% of the breaking load of the chain without any permanent deformation of the stressed parts or brake slip.

3.7.3 Chain stoppers *(1/7/2018)*

Where a chain stopper is fitted, it is to be able to withstand a pull of 80% of the breaking load of the chain and the windlass is to be able to withstand a pull of 45% of the breaking load of the chain without any permanent deformation of the stressed part or brake slip.

Where a chain cable stopper is fitted, a windlass with brakes applied and the cable lifter declutched is to be able to withstand a pull of 45% of the breaking load of the chain without any permanent deformation of the stressed parts or brake slip.

3.7.4 Strength criteria for windlass subject to anchor and chain loads

The stresses on the parts of the windlass, its frame and stopper are to be less than the yield stress of the material used.

For the calculation of the above stresses, special attention is to be paid to:

- stress concentrations in keyways and other stress raisers,
- dynamic effects due to sudden starting or stopping of the prime mover or anchor chain,
- calculation methods and approximation.

3.7.5 Green sea loads *(1/1/2004)*

For ships of length 80 m or more, where the height of the exposed deck in way of the item is less than 0,1L or 22 m above the summer load waterline, whichever is the lesser, the securing devices of windlasses located within the forward quarter length of the ship are to resist green sea forces.

The green sea pressure and associated areas are to be taken equal to (see Fig 9):

- 200 kN/m^2 normal to the shaft axis and away from the forward perpendicular, over the projected area in this direction,
- 150 kN/m^2 parallel to the shaft axis and acting both inboard and outboard separately, over the multiple of f times the projected area in this direction,

where:

f : 1+ B/H, but not greater than 2,5

B : width of windlass measured parallel to the shaft axis,

H : overall height of windlass.

Where mooring winches are integral with the anchor windlass, they are to be considered as part of the windlass.

3.7.6 Forces in the securing devices of windlasses due to green sea loads *(1/1/2004)*

Forces in the bolts, chocks and stoppers securing the windlass to the deck are to be calculated by considering the green sea loads specified in [3.7.5].

The windlass is supported by N bolt groups, each containing one or more bolts (see also Fig 10).

The axial force R_i in bolt group (or bolt) i, positive in tension, is to be obtained, in kN, from the following formulae:

$R_{xi} = P_x\, h_{xi}\, A_i / I_x$

$R_{yi} = P_y\, h_{yi}\, A_i / I_y$

and $R_i = R_{xi} + R_{yi} - R_{si}$

where:

P_x : force, in kN, acting normal to the shaft axis

SECTION 2 DIESEL ENGINES

1 General

1.1 Application

1.1.1 *(1/7/2019)*

Diesel engines listed below are to be designed, constructed, installed, tested and certified in accordance with the requirements of this Section, under the supervision and to the satisfaction of the Society's Surveyors:

a) main propulsion engines

b) engines driving electrical generators and other auxiliaries essential for safety and navigation and cargo pumps in tankers, when they develop a power of 110 kW and over.

All other engines are to be designed and constructed according to sound marine practice, with the equipment required in [4.3.4], [4.5.2], [4.7.2] [4.7.3], [4.7.5] and [4.7.8] and delivered with the relevant works' certificate (see Pt D, Ch 1, Sec 1, [4.2.3]).

Additional requirements for control and safety systems for dual fuel engines supplied with high pressure methane gas are given in App 2.

Additional requirements for trunk piston engines supplied with low pressure natural gas are given in App 12.

In addition to the requirements of this Section, those given in Sec 1 apply.

1.2 Type approval certificate

1.2.1 *(1/7/2016)*

For each type of engine that is required to be certified, a type approval certificate is to be obtained by the engine designer.

The type approval process consists of:

- drawing and specification approval,
- conformity of production,
- approval of type testing programme,
- type testing of engines,
- review of the obtained type testing results,
- evaluation of the manufacturing arrangements,
- issue of a type approval certificate upon satisfactorily meeting the Rule requirements.

1.3 Engine certificate

1.3.1 *(1/7/2016)*

Each diesel engine manufactured for a shipboard application per [1.1.1] is to have an engine certificate:

The certification process consists of:

- the engine builder/licensee obtaining design approval of the engine application specific documents, if any, by submitting a comparison list of the production drawings to the previously approved engine design drawings referenced in [1.2.1]
- forwarding the relevant production drawings and comparison list for the use of the Surveyors at the manufacturing plant and shipyard if necessary
- engine's components testing and engine works trials
- the issuance of an engine certificate upon satisfactorily meeting the Rule requirements.

1.4 Documentation

1.4.1 Document flow for obtaining a type approval certificate *(1/7/2016)*

a) For the initial engine type, the engine designer is to submit to the Society the documentation in accordance with requirements in Tab 1 and Tab 2.

b) Upon review and approval of the submitted documentation (evidence of approval), it will be returned to the engine designer.

c) The engine designer arranges for a Surveyor to attend an engine type test

d) Upon satisfactory testing and examination of relevant reports, the Society issues a type approval certificate.

1.4.2 Document flow for engine certificate *(1/7/2016)*

a) The engine type must have a type approval certificate. For the first engine of a type, process and the engine certification process (ECP) may be performed simultaneously.

b) Engines to be installed in specific applications may require the engine designer/licensor to modify the design or performance requirements. The modified drawings are forwarded by the engine designer to the engine builder/licensee to develop production documentation for use in the engine manufacture in accordance with Tab 3.

c) The engine builder/licensee develops a comparison list of the production documentation to the documentation listed in Tab 1 and Tab 2. An example comparison list is provided in App 10. If there are differences in the technical content on the licensee's production drawings/documents compared to the corresponding licensor's drawings, the licensee must obtain agreement to such differences from the designer using the template in App 11.

If the designer agreement is not confirmed, the engine is to be regarded as a different engine type and is to be

5 Arrangement and installation

5.1 Starting arrangements

5.1.1 Mechanical air starting *(1/1/2023)*

a) Air starting the main and auxiliary engines is to be arranged such that the necessary air for the first charge can be produced on board the ship without external aid.

b) The total capacity of air receivers is to be sufficient to provide, without replenishment, not less than 12 consecutive starts alternating between ahead and astern of each main engine of the reversible type, and not less than 6 consecutive starts of each main non-reversible type engine connected to a controllable pitch propeller or other device enabling the start without opposite torque.

~~The number of starts refers to the engine in cold and ready to start condition (all the driven equipment that cannot be disconnected is to be taken into account).~~

~~A greater number of starts may be required when the engine is in warm running condition.~~

When other users such as auxiliary engine starting systems, control systems, whistle etc. are connected to the starting air receivers of main propulsion engines, their air consumption is also to be taken into account.

Regardless of the above, for multi-engine installations the total number of starts required to be provided from the starting air receivers is indicated in Tab 7, valid when all the air receivers may be used to start all propulsion engines; if each engine or group of engines connected to a shaft is fitted with dedicated air receivers, the minimum number of starts for each group of engines connected to the same shaft is 12 for reversible engines and 6 for non-reversible engines.

In case of Diesel-electric or turbine-electric propulsion, the minimum number of total consecutive starts required to be provided from the starting air receivers is to be determined from the following equation:

$S = 6 + N (N - 1)$

where

S : total number of consecutive starts

N : number of engines. (need not to be greater than 3).

c) If other compressed air systems, such as control air, are supplied from the same starting air receivers, the total capacity of the receivers is to be sufficient for continued operation of these systems after the air necessary for the required number of starts has been used.

d) The main starting air arrangements for main propulsion or auxiliary diesel engines are to be adequately protected against the effects of backfiring and internal explosion in the starting air pipes. To this end, the following safety devices are to be fitted:

- An isolating non-return valve, or equivalent, at the starting air supply connection to each engine.
- A bursting disc or flame arrester:
  - in way of the starting valve of each cylinder, for direct reversing engines having a main starting air manifold
  - at least at the supply inlet to the starting air manifold, for non-reversing engines.

  The bursting disc or flame arrester above may be omitted for engines having a bore not exceeding 230 mm.

Other protective devices will be specially considered by the Society.

The requirements of this item d) do not apply to engines started by pneumatic motors.

e) Compressed air receivers are to comply with the requirements of Sec 3. Compressed air piping and associated air compressors are to comply with the requirements of Sec 10.

5.1.2 Electrical starting *(1/7/2016)*

a) Where main internal combustion engines are arranged for electrical starting, at least two separate batteries are to be fitted.

The arrangement is to be such that the batteries cannot be connected in parallel.

Each battery is to be capable of starting the main engine when in cold and ready to start condition.

The combined capacity of batteries is to be sufficient to provide within 30 min, without recharging, the number of starts required in [5.1.1] (b) in the event of air starting.

b) Electrical starting arrangements for auxiliary engines are to have two separate storage batteries or may be supplied by two separate circuits from main engine storage batteries when these are provided. In the case of a single auxiliary engine, one battery is acceptable. The combined capacity of the batteries is to be sufficient for at least three starts for each engine.

c) The starting batteries are only to be used for starting and for the engine's alarm and monitoring. Provision is to be made to maintain the stored energy at all times.

d) Each charging device is to have at least sufficient rating for recharging the required capacity of batteries within 6 hours.

Table 7 : Required number of starts *(1/7/2016)*

	Single propeller vessels		Multiple propeller vessels	
Engine type	One engine per shaft	Two or more engines per shaft	One engine per shaft	Two or more engines per shaft
Reversible	12	16	24	24
Non-reversible	6	8	8	8

SECTION 3 BOILERS AND PRESSURE VESSELS

1 General

1.1 Principles

1.1.1 Scope of the Rules

The boilers and other pressure vessels, associated piping systems and fittings shall be of a design and construction adequate for the service for which they are intended and shall be so installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to moving parts, hot surfaces and other hazards. The design is to have regard to materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board.

1.1.2 Continuity of service

The Society shall give special consideration to the reliability of single essential propulsion components and may require a separate source of propulsion power sufficient to give the ship a navigable speed, especially in the case of unconventional arrangements.

1.1.3 Propulsion capability

Means shall be provided whereby normal operation of main boilers can be sustained or restored even though one of the essential auxiliaries becomes inoperative. Special consideration is to be given to the malfunctioning of:

- *the sources of steam supply*
- *the boiler feed water systems*
- *the fuel oil supply systems for boilers;*
- *the mechanical air supply for boilers.*

However, the Society, having regard to overall safety considerations, may accept a partial reduction in propulsion capability from normal operation.

1.1.4 Tests

All boilers and other pressure vessels including their associated fittings which are under internal pressure shall be subjected to appropriate tests including a pressure test before being put into service for the first time (see also [7]).

1.1.5 Protection against overpressure

Where main or auxiliary boilers and other pressure vessels or any parts thereof may be subject to dangerous overpressure, means shall be provided where practicable to protect against such excessive pressure.

1.2 Application

1.2.1 Boilers and pressure vessels covered by the Rules

The requirements of this Section apply to:

- all boilers and other steam generators, including the associated fittings and mountings with the exception of those indicated in [1.2.2]
- pressure vessels of metallic construction and heat exchangers, including the associated fittings and mountings with the exception of those indicated in [1.2.2].

1.2.2 Boilers and pressure vessels not covered by the Rules

The following boilers and pressure vessels are not covered by the Rules and will be considered on a case by case basis:

a) boilers with design pressure $p > 10$ MPa

b) pressure vessels intended for radioactive material

c) small pressure vessels included in self-contained domestic equipment.

1.2.3 Pressure vessels not requiring design approval *(1/7/2003)*

Plan approval is not required for pressure vessels of class 3 (as specified in [1.4]), having design pressure $p \leq 1$ MPa and product $p\ V \leq 150$ (V being the internal volume, in dm^3, calculated deducting the volume of tube bundles, if any).

However, the Society reserves the right to apply all or part of the requirements of this Section to class 3 heat exchangers and pressure vessels, depending on the criticality of the equipment and/or of the system of which they are part.

1.2.4 Pressure vessels covered in other parts of the Rules

Specific requirements relative to pressure vessels for liquefied gases and pressure vessels for refrigerating plants are stipulated in Part E, Chapter 9 and Part F, Chapter 8 respectively.

1.3 Definitions

1.3.1 Pressure vessel

Pressure vessel is a welded or seamless container used for the containment of fluids at a pressure above or below the ambient pressure and at any temperature. Fluid power cylinders in hydraulic or pneumatic plants are also considered pressure vessels.

1.3.2 Fired pressure vessel

Fired pressure vessel is a pressure vessel which is completely or partially exposed to fire from burners or combustion gases.

2.6.2 Steam condensers

a) The water chambers and steam spaces are to be fitted with doors for inspection and cleaning.

b) Where necessary, suitable diaphragms are to be fitted for supporting tubes.

c) Condenser tubes are to be removable.

d) High speed steam flow, where present, is to be prevented from directly striking the tubes by means of suitable baffles.

e) Suitable precautions are to be taken in order to avoid corrosion on the circulating water side and to provide an efficient grounding.

2.7 Additional requirements for shell type exhaust gas economisers

2.7.1 Application *(1/7/2008)*

These requirements apply to shell type exhaust gas economisers that are intended to be operated in a flooded condition and that can be isolated from the steam piping system.

2.7.2 Design and Construction *(1/7/2008)*

Design and construction of shell type exhaust gas economisers are to pay particular attention to the welding, heat treatment and inspection arrangements at the tube plate connection to the shell.

2.7.3 Pressure Relief *(1/7/2016)*

The requirements given in [2.3.1] apply.

To avoid the accumulation of condensate on the outlet side of safety valves, the discharge pipes and/or safety valve housings are to be fitted with drainage arrangements from the lowest part, directed with continuous fall to a position clear of the shell type exhaust gas economisers where it will not pose threats to either personnel or machinery. No valves or cocks are to be fitted in the drainage arrangements.

Full details of the proposed arrangements to satisfy the requirements in this paragraph are to be submitted for approval.

2.7.4 Pressure Indication *(1/7/2008)*

Every shell type exhaust gas economiser is to be provided with a means of indicating the internal pressure located so that the pressure can be easily read from any position from which it may be controlled.

2.7.5 Lagging *(1/7/2008)*

Every shell type exhaust gas economiser is to be provided with removable lagging at the circumference of the tube end plates to enable ultrasonic examination of the tube plate to shell connection.

2.7.6 Feed Water *(1/7/2008)*

Every shell type exhaust gas economiser is to be provided with arrangements for preheating and de-aeration, addition of water treatment or combination thereof to control the quality of feed water to within the Manufacturer's recommendations.

2.7.7 Operating Instructions *(1/7/2008)*

The Manufacturer is to provide operating instructions for each shell type exhaust gas economiser which are to include reference to:

a) Feed water treatment and sampling arrangements

b) Operating temperatures - exhaust gas and feed water temperatures

c) Operating pressure

d) Inspection and cleaning procedures

e) Records of maintenance and inspection

f) The need to maintain adequate water flow through the economiser under all operating conditions

g) Periodical operational checks of the safety devices to be carried out by the operating personnel and to be documented accordingly

h) Procedures for using the exhaust gas economiser in the dry condition

i) Procedures for maintenance and overhaul of safety valves.

3 Design and construction - Scantlings

3.1 General

3.1.1 Application

a) In general, the formulae in this Section do not take into account additional stresses imposed by effects other than pressure, such as stresses deriving from the static and dynamic weight of the vessel and its content, external loads from connecting equipment and foundations, etc. For the purpose of the Rules these additional loads may be neglected, provided it can reasonably be presumed that the actual average stresses of the vessel, considering all these additional loads, would not increase more than 10% with respect to the stresses calculated by the formulae in this Section.

b) Where it is necessary to take into account additional stresses, such as dynamic loads, the Society reserves the right to ask for additional requirements on a case by case basis.

3.1.2 Additional requirements

When pressure parts are of an irregular shape, such as to make it impossible to check the scantlings by applying the formulae of this Section, the approval is to be based on other means, such as burst and/or deformation tests on a prototype or by another method agreed upon between the manufacturer and the Society.

3.2 Permissible stresses

3.2.1 Permissible stress tables

The permissible stresses K, in N/mm^2, for steels, to be used in the formulae of this Section, may be determined from Tab 6, Tab 7, Tab 8 and Tab 9, where R_m is the ultimate strength of the material in N/mm^2. For intermediate values of the temperature, the value of K is to be obtained by linear interpolation.

f) Additional conditions:

- In special cases the Society reserves the right to apply values of permissible stress K lower than those specified above.
- In the case of boilers or other steam generators, the permissible stress K is not to exceed 170 N/mm^2.
- For materials other than those listed above the permissible stress is to be agreed with the Society on a case by case basis.

3.3 Cylindrical, spherical and conical shells with circular cross-sections subject to internal pressure

3.3.1 Cylindrical shell thickness

a) The minimum thickness of cylindrical, spherical and conical shells with circular cross-sections is not to be less than the value t, in mm, calculated by one of the following formulae, as appropriate. Cylindrical tube plates pierced by a great number of tube holes are to have thickness calculated by the applicable formula in [3.3.2], [3.3.3], [3.3.4] and [3.7.2].

b) The thicknesses obtained by the formulae in [3.3.2], [3.3.3], [3.3.4], are "net" thicknesses, as they do not include any corrosion allowance. Unless a greater value is agreed in the vessel contract specification, the thickness obtained by the above formulae is to be increased by 0.75 mm. See also [3.3.7].

3.3.2 Cylindrical shells

a) When the ratio external diameter/inside diameter is equal to or less than 1,5, the minimum thickness of cylindrical shells is given by the following formula:

$$t = \frac{pD}{2Ke - p}$$

where:

p : Design pressure, in MPa

D : Inside diameter of vessel, in mm

K : Permissible stress, in N/mm^2, obtained as specified in [3.2]

e : Efficiency of welded joint. For the value of the efficiency e, see [3.3.5].

b) The minimum thickness of shells having ratio external diameter/inside diameter exceeding 1,5 is subject of special consideration.

3.3.3 Spherical shells

a) When the ratio external diameter/inside diameter is equal to or less than 1,5, the minimum thickness of spherical shells is given by the following formula:

$$t = \frac{pD}{4Ke - p}$$

For the meaning of the symbols, see [3.3.2].

b) The minimum thickness of shells having ratio external diameter/inside diameter exceeding 1,5 is subject of special consideration.

3.3.4 Conical shells

a) The following formula applies to conical shells of thickness not exceeding 1/6 of the external diameter in way of the large end of the cone.

$$t = \frac{pD}{(2Ke - p) \cdot \cos\varphi}$$

For the meaning of the symbols, see [3.3.2].

D is measured in way of the large end of the cone and φ is the angle of slope of the conical section of the shell to the pressure vessel axis (see Fig 2). When φ exceeds 75°, the shell thickness is to be taken as required for flat heads, see [3.5].

b) The minimum thickness of shells having thickness exceeding 1/6 of the external diameter in way of the large end of the cone is subject of special consideration.

c) Conical shells may be made of several ring sections of decreasing thickness. The minimum thickness of each section is to be obtained by the formula in a) using for D the maximum diameter of the considered section.

d) In general, the junction with a sharp angle between the conical shell and the cylindrical or other conical shell, having different angle of slope, is not allowed if the angle of the generating line of the shells to be assembled exceeds 30°.

e) The shell thickness in way of knuckles is subject of special consideration by the Society.

3.3.5 Efficiency

The values of efficiency e to be used in the formulae in [3.3.2], [3.3.3] and [3.3.4] are indicated in Tab 10.

Table 10 : Efficiency of unpierced shells *(1/7/2004)*

Case	e
Seamless shells	1
Shells of class 1 vessels **(1)**	1
Shells of class 2 vessels (with partial radiographic examination of butt-joints)	0,85
Shells of class 2 vessels (without radiographic examination of butt-joints)	0,75
Shells of class 3 vessels	0,6
(1) In special cases the Society reserves the right to take a factor e < 1, depending on the welding procedure adopted for the welded joint.	

3.3.6 Minimum thickness *(1/7/2009)*

Irrespective of the value calculated by the formulae in [3.3.2], [3.3.3] [3.3.4], the thickness t of shells is to be not less than one of the following values, as applicable:

- for pressure vessels:
  - in carbon and low alloy steel: t = 3 + D/1500 mm
  - in stainless steel and non-ferrous materials: t = 3 mm
- for unpierced plates of boilers: t = 6 mm
- for boiler cylindrical tube plates: t = 9,5 mm.

No corrosion allowance needs to be added to the above values.

using an efficiency value e equal to 1 without corrosion constant.

b) The area corresponding to the maximum opening diameter for which compensation is not required may be deducted from the computation of the compensating area to be provided.

c) Material around the opening outside the width exceeding the opening radius in any direction is not to be included in the calculation of the compensation.

d) Excess thickness in the shell with respect to the Rule thickness t, calculated as indicated in a), may be considered as contributing to the compensation of the opening for a width not exceeding the opening radius.

e) Where nozzles are welded to the shell, their excess thickness with respect to the Rule thickness, calculated in accordance with the requirements in [3.6.1], may be considered as contributing to the compensation of the hole for a height h, in mm, equal to:

$$h = [(d_B - 2t_B) \cdot t_B]^{0.5}$$

where d_B and t_B are the values, in mm, of the outer diameter and thickness of the nozzle, respectively. See also Fig 3.

f) The sectional area of welds connecting compensating parts may be included in the compensation calculation if they fall inside the area mentioned in a).

g) If the material of rings, nozzles and reinforcement collars has a lower permissible stress than the shell material, the compensating area is to be proportionally increased.

h) Fig 3 summarises the compensation criteria described in the above items.

i) Different arrangements will be specially considered by the Society on a case by case basis.

3.3.11 Cylindrical shells pierced by tube holes

For the minimum thickness of cylindrical shells pierced by tube holes, see [3.7.1].

3.3.12 Covers *(1/1/2023)*

a) Circular, oval and elliptical inspection openings are to be provided with steel covers. Inspection openings on boilers with a diameter not exceeding 150 mm and on pressure vessels may be closed by blind flanges.

b) The thickness of the opening covers is not to be less than the value t, in mm, given by the following formula:

$$t = 1{,}22 \cdot a \cdot \left(\frac{pC}{K}\right)^{0.5}$$

where:

a : The minor axis of the oval or elliptical opening, measured at half width of gasket, in mm

b : The major axis of the oval or elliptical opening, measured at half width of the gasket, in mm

C : Coefficient in Tab 11 as a function of the ratio b/a of the axes of the oval or elliptical opening, as defined above. For intermediate values of the ratio b/a, the value of C is to be obtained by linear interpolation.

For circular openings the diameter d, in mm, is to be used in the above formula instead of a.

c) The thickness obtained by the formula in a) is "net" thickness, as it does not include any corrosion allowance. Unless a greater value is agreed in the vessel contract specification, the thickness obtained by the above formula is to be increased by 1 mm. See also [3.3.7]

d) The formula in b) above is calibrated for flat covers.

e) For concave covers, also scantlings based on the formula for concave heads in [3.4.3] may be accepted to the satisfaction of the Society.

f) The provisions of this paragraph also apply to covers located on the dished heads.

SECTION 5 GAS TURBINES

1 General

1.1 Application

1.1.1 Propulsion turbines and turbines for essential services

The requirements of this Section apply to:

a) all propulsion turbines

b) turbines intended for auxiliary services essential for safety and navigation.

1.1.2 Turbines for auxiliary generators

In addition to the requirements contained in this Section, auxiliary turbines driving electric generators are to comply with the applicable requirements of Chapter 2 of the Rules.

1.1.3 Type approval

Turbines intended for propulsion and essential services are to be type approved by the Society.

1.2 Definition of rated power

1.2.1 Rated power is the maximum constant power that the turbine can develop at constant speed in the range of air inlet temperature between 0°C and 35°C. This power is to be considered with 0 intake and exhaust losses and with an air relative humidity of 60%.

1.3 Documentation to be submitted

1.3.1 For propulsion turbines and turbines intended for driving machinery for essential services, the plans listed in Tab 1 are to be submitted.

The listed constructional plans are to be complete with all dimensions and are to contain full indication of the types of materials used.

2 Design and Construction

2.1 Materials

2.1.1 Approved materials

a) Gas turbine materials are to fulfil the requirements imposed by the operating conditions of the individual components. In the choice of materials, account is to be taken of effects such as creep, thermal fatigue, oxidation and corrosion to which individual components are subject when in service. Evidence of the suitability of the materials is to be supplied to the Society in the form of details of their chemical and mechanical properties and of the heat treatment applied. Where composite materials are used, their method of manufacture is to be described.

b) Turbine blades are to be built of corrosion and heat-resistant materials.

2.2 Stress analyses

2.2.1 Calculation

a) The manufacturer is to submit the results of calculation of the stresses on each rotor under the most severe service conditions.

b) Fatigue analysis on each rotor, taking into account the stress concentrations, is also to be submitted.

c) The results of previous in-service experience on similar applications may be considered by the Society as an alternative to items a) and b) above.

The calculations and analyses (see also [1.3.1]) are to be carried out in accordance with criteria agreed by the Society. Data on the design service life and test results used to substantiate calculation assumptions are also to be provided.

2.2.2 Vibrations

The range of service speeds is not to give rise to unacceptable bending vibrations or to vibrations affecting the entire installation. Calculations of the critical speeds including details of their basic assumptions are to be submitted.

2.3 Design and constructional details

2.3.1 Rotors and stators

a) All components of turbines and compressors are to be free from defects and are to be built and installed with tolerances and clearances in order to allow thermal expansion and to minimise the distortions of casings and rotors in all expected service conditions.

b) Adequate drain tubes and cocks are to be arranged in a suitable position, in the lower parts of the casings. Cocks are to be easily operated.

c) Suitable protective devices are to be provided in order to prevent heat, noise or possible failure of rotating parts from causing injury to personnel. If, to this end, the whole gas turbine is enclosed in a protective covering, the covering is to be adequately ventilated inside.

d) Particular attention is to be paid to the connection in the casings of pipes to the turbine stators in order to avoid abnormal loads in service.

e) Smooth fillets are to be provided at changes of sections of rotors, discs and blade roots. The holes in discs are to be well rounded and polished.

Table 1 : Documents to be submitted *(1/1/2023)*

No.	A/I **(1)**	ITEM
1	I	Sectional assembly
2	A	Detailed drawings of rotors, casings, blades, combustion chambers and heat exchangers **(2)**
3	A	Material specifications of the major parts, including their physical, chemical and mechanical properties, the data relevant to rupture and creep at elevated temperatures, the fatigue strength, the corrosion resistance and the heat treatments **(2)**
4	A	Where the rotors, stators or other components of turbines are of welded construction, all particulars on the design of welded joints, welding procedures and sequences, heat treatments and non-destructive examinations after welding **(2)**
5	I	General specification of the turbine, including instruction manual, description of structures and specification of the properties of fuel and lubricating oil to be used
6	I	Details of operating conditions, including the pressure and temperature curves in the turbine and compressor at the rated power and corresponding rotational speeds, and details of permissible temporary operation beyond the values for the rated power
7	A	Diagrammatic layout of the fuel system, including control and safety devices, and of the lubricating oil system
8	A	Cooling system layout, if applicable
9	I	Where applicable, background information on previous operating experience in similar applications
10	I	Maintenance and overhaul procedures
11	A	Stress and temperature analysis in blades, rotors and combustion chamber **(2)**
12	A	Life time calculation of hot and high stress parts **(2)**
13	A	Blade and rotor vibration analysis **(2)**
14	A	Details of automatic safety devices together with failure mode and effect analysis (FMEA) **(2)**

(1) A = to be submitted for approval in four copies
I = to be submitted for information in duplicate

(2) As an alternative, the Society may, on a case by case basis, consider reviewing a number of selected packages relative to important and critical parts of the turbine, where all the design, construction, inspection, testing and acceptance criteria used by the manufacturer are clearly described, provided the Quality Assurance system of the manufacturer is approved and certified by the Society.

2.3.2 Access and inspection openings

a) Access to the combustion chambers is to be ensured. Means are to be provided to inspect the burner cans or combustion chamber without having to remove the gas generator.

b) Inspection openings are to be provided to allow the gas turbine flow path air to be inspected with special equipment, e.g. a bore-scope or similar, without the need for dismantling.

2.3.3 Bearings

a) Turbine bearings are to be so located that their lubrication is not impaired by overheating from hot gases or adjacent hot parts.

b) Lubricating oil or fuel oil is to be prevented from dripping on high temperature parts.

c) Suitable arrangements for cooling the bearings after the turbines have been stopped are to be provided, if necessary to prevent bearing cooking.

d) Roller bearings are to be identifiable and are to have a life adequate for their intended purpose. In any event, their life cannot be less than 40000 hours.

2.3.4 Turning gear

a) Main propulsion turbines are to be equipped with turning gear or a starter for cranking. The rotors of auxiliary turbines are to be capable of being turned by hand.

b) The engagement of the turning gear or starter is to be visually indicated at the control platform.

c) An interlock is to be provided to ensure that the main turbine cannot be started up when the turning gear is engaged.

2.3.5 Cooling

The turbines and their external exhaust system are to be suitably insulated or cooled to avoid excessive outside temperature.

2.3.6 Air supply

a) The air intake ducting is to be equipped to prevent extraneous substances from entering the compressor and turbine.

b) Measures are to be taken to control the salinity of the combustion air, to meet the manufacturer's specification.

2.5.4 Emergency shut-off

a) An emergency push-button shut-off device is to be provided at the control console.

b) Any shut-off device provided in pursuance of the above is to shut off the fuel supply as near the burners as possible.

2.5.5 Quick-closing devices

a) Re-setting of the quick-closing device may be effected only at the turbine or from the control platform with the fuel supply control valve in the closed position.

b) When the devices are operated by hydraulic oil systems fitted for automatic operation, they are to be fed by two pumps: one main pump and one standby pump. In any event, the standby pump is to be independent. In special cases, a hand-operated pump may be accepted as a standby pump.

c) The starting up of any turbine is to be possible only when the quick-closing devices are ready for operation.

2.5.6 Automatic temperature controls

The following turbine services are to be fitted with automatic temperature controls so as to maintain steady state conditions within the normal operating range of the main gas turbine:

a) lubricating oil supply and discharge

b) fuel oil supply (or, alternatively, automatic control of fuel oil viscosity)

c) exhaust gas in specific locations of the flow gas path as determined by the manufacturer.

2.5.7 Summary table *(1/1/2023)*

Tab 2 indicates the minimum control, monitoring and shutdown requirements for main propulsion and auxiliary turbines.

Unless the FMEA required in this Section proves otherwise, the shutdown functions for gas turbines are to be provided in accordance with Tab 2.

Although in principle alarming devices listed in Tab 2 are to be provided, they can be added or omitted, taking into account the result of FMEA.

Note 1: Some departures from Tab 2 may be accepted by the Society in the case of ships with a restricted navigation notation.

Table 2 : Main propulsion and auxiliary turbines *(1/1/2023)*

Symbol convention H = High, HH = High high, G = group alarm L = Low, LL = Low low, I = individual alarm X = function is required, R = remote	Monitoring		Automatic control				
			Turbine			Auxiliary	
Identification of system parameter	Alarm	Indication	Slow-down	Shut-down	Control	Stand by Start	Stop
• Control system failure	X						
• Automatic starting failure	X						
Mechanical monitoring of gas turbine							
• Speed		local					
					X		
	H			X			
• Rotor axial displacement (Not applicable to roller bearing)		local					
	H			X			
• Vibration	H*	local		X			
• Performed number of cycle of rotating part	H						
Gas generator monitoring							
• Flame and ignition failure	X			X			
• Fuel oil supply pressure	L	local					
• Fuel oil supply temperature	H	local					
• Cooling medium temperature	H	local					
• Exhaust gas temperature or gas temperature in specific locations of flow gas path. (Alarm before shutdown)		local					
	H*			X			
• Vacuum ~~P~~pressure at the compressor inlet (alarm before shutdown)		local					
	~~L~~H*			X			
Lubricating oil							

Symbol convention H = High, HH = High high, G = group alarm L = Low, LL = Low low, I = individual alarm X = function is required, R = remote	Monitoring		Automatic control				
			Turbine			Auxiliary	
Identification of system parameter	Alarm	Indication	Slow-down	Shut-down	Control	Stand by Start	Stop
• Turbine supply pressure		local					
	L*			X			
• Lubricating oil pressure of reduction gear		local					
	L*			X			
• Differential pressure across lubricating oil filter	H	local					
• Bearing or lubricating oil (discharge) temperature	H	local					
Notes: 1) Alarms marked with "*" are to be activated at the suitable setting points prior to arriving the critical condition for the activation of shutdown devices.							

3 Arrangement and installation

3.1 Foundations

3.1.1 Foundations of turbines and connected reduction gears are to be designed and built so that hull movements do not give rise to significant movements between reduction gears and turbines. In any event, such movements are to be absorbed by suitable couplings.

3.2 Joints of mating surfaces

3.2.1 The mating flanges of casings are to form a tight joint without the use of any interposed material.

3.3 Piping installation

3.3.1 Pipes and mains connected to turbine and compressor casings are to be fitted in such a way as to minimise the thrust loads and moments. If flexible hoses are used for this purpose, they are to comply with the requirements in Sec 10, [2.6].

3.4 Hot surfaces

3.4.1 Hot surfaces with which the crew are likely to come into contact during operation are to be suitably guarded or insulated. See Sec 1, [3.7].

3.5 Alignment

3.5.1

a) Particular care is to be taken in the alignment of turbine-reduction gearing, taking account of all causes which may alter the alignment from cold conditions to normal service conditions.

b) When a structural tank is fitted in way of the turbine or gearing foundations, the expected tank temperature variations are to be taken into account during alignment operations.

c) Propulsion turbines are to be fitted with indicators showing the axial movements of rotors with respect to casings and the sliding movements of casings on the sliding feet. Such indicators are to be fitted in an easily visible position. This requirement does not apply to turbines fitted with roller bearings.

3.6 Gratings

3.6.1 Gratings and any other structures in way of the sliding feet or flexible supports are to be so arranged that turbine casing expansion is not restricted.

3.7 Drains

3.7.1 Turbines and the associated piping systems are to be equipped with adequate means of drainage.

3.8 Instruments

3.8.1 Main and auxiliary turbines are to be fitted with callipers and micrometers of a suitable type for verifying the alignment of rotors and pinion and gear-wheel shafts, when necessary.

At the time of installation on board, this check is to be performed in the presence and to the satisfaction of the Surveyor.

4 Material tests, workshop inspection and testing, certification

4.1 Type tests - General

4.1.1 Upon finalisation of the design for production of every new turbine type intended for installation on board ships, one turbine is to be presented for type testing as required below.

SECTION 14 TURBOCHARGERS

1 General

1.1 Application

1.1.1 *(1/7/2016)*

These Rules apply to turbochargers with regard to design approval, type testing and certification and their matching on engines.

1.1.2 *(1/7/2016)*

Turbochargers are to be type approved, either separately or as a part of an engine. The requirements are written for exhaust gas driven turbochargers, but apply in principle also for engine driven chargers.

The requirements escalate with the size of the turbochargers. The parameter for size is the engine power (at MCR) supplied by a group of cylinders served by the actual turbocharger, (e.g. for a V-engine with one turbocharger for each bank the size is half of the total engine power).

1.1.3 *(1/7/2016)*

Turbochargers are categorized in three groups depending on served power by cylinder groups with:

- Category A: $\leq$ 1000 kW
- Category B: > 1000 kW and $\leq$ 2500 kW
- Category C: > 2500 kW

1.1.4 In the case of special types of turbochargers, the Society reserves the right to modify the requirements of this Section, demand additional requirements in individual cases and require that additional plans and data be submitted.

1.1.5 *(1/1/2023)*

Turbochargers with an existing type approval on 1 January 2023 are not required to be re-type approved in accordance with this Section until the current Type Approval reaches its expiry date.

1.2 Documentation to be submitted

1.2.1 *(1/7/2016)*

The Manufacturer is to submit to the Society the following documents.

1.2.2 *(1/7/2016)*

For Category A turbochargers:

On request:

- containment test report;
- cross sectional drawing with principal dimensions and names of components;
- test program.

1.2.3 *(1/7/2016)*

For Category B and C turbochargers:

- cross sectional drawing with principal dimensions and materials of housing components for containment evaluation;
- documentation of containment in the event of disc fracture;
- operational data and limitations as;
- maximum permissible operating speed (rpm);
- alarm level for over-speed;
- maximum permissible exhaust gas temperature before turbine;
- alarm level for exhaust gas temperature before turbine;
- minimum lubrication oil inlet pressure;
- lubrication oil inlet pressure low alarm set point;
- maximum lubrication oil outlet temperature;
- lubrication oil outlet temperature high alarm set point;
- maximum permissible vibration levels, i.e. self- and externally generated vibration.

  (Alarm levels may be equal to permissible limits but shall not be reached when operating the engine at 110% power or at any approved intermittent overload be-yond the 110%);
- arrangement of lubrication system, all variants within a range;
- type test reports;
- test program.

1.2.4 *(1/7/2016)*

For Category C turbochargers:

- drawings of the housing and rotating parts including details of blade fixing;
- material specifications (chemical composition and mechanical properties) of all parts mentioned above;
- welding details and welding procedure of above mentioned parts, if applicable;
- documentation of safe torque transmission when the disc is connected to the shaft by an interference fit, see [2.2.4];
- information on expected lifespan, considering creep, low cycle fatigue and high cycle fatigue;
- operation and maintenance manuals (see Note 1).

Note 1: Applicable to two sizes in a generic range of turbochargers.

1.2.5 *(1/7/2016)*

When the turbochargers are manufactured by a licensee on the basis of a previously type approved licensor design, but using parts manufactured outside of the licensor premises and making use of other than the original licensor drawings and specifications, the licensee is to submit, for each turbocharger type, a list of all the drawings specified above, indi-

APPENDIX 7 ~~GAS~~LNG FUELLED OR CNG FUELLED SHIPS

1 General

1.1 Application

1.1.1 *(1/1/2017)*

The provisions of this Appendix apply to the arrangement, installation, control and monitoring of machinery, equipment and systems of ships using low-flashpoint fuel other than ships covered by the IGC Code (hereinafter named 'gas-fuelled ships'). These ships are to comply with the requirements of the latest version of the International Code of Safety for Ships using Gases or other Low-Flashpoint Fuels (IGF Code), as amended. In these Rules, reference to this Code and its amendments is made by the wording "IGF Code".

Consistently with the status of the IGF Code, the current version of this Appendix includes regulations to meet the functional requirements for natural gas fuel.

For other low-flashpoint fuels, compliance with the functional requirements of this Appendix is to be demonstrated through alternative design.

1.1.2 Acceptance by the flag Administration *(1/1/2017)*

The use of gas as fuel in ships requires additional acceptance by the Administration of the State whose flag the ship is entitled to fly.

1.1.3 IGF Code requirements and the Society's rules *(1/1/2017)*

a) For gas-fuelled ships, the IGF Code requirements are to be considered as rule requirements;

b) the requirements of this Appendix include additional mandatory class requirements, as well as the Society's interpretations of the IGF Code, which are also to be considered mandatory for Class;

c) in general, this Appendix applies to machinery, equipment and systems of gas-fuelled ships using low-flashpoint fuel and to the interfaces between these systems and the other parts of the ship, which are to comply with the applicable Sections of the hull and machinery Rules.

1.1.4 IGF Code requirements and the Society's rules *(1/1/2017)*

The following requirements of the IGF Code are not within the scope of classification:

- Chapter 11 - Fire Safety
- Chapter 17 - Drills and emergency exercises
- Chapter 18 - Operation
- Chapter 19 - Training.

These requirements are applied by the Society when acting on behalf of the flag Administration, within the scope of delegation (see [1.1.6]).

1.1.5 Correspondence of the IGF Code with Part C Chapter 1, Appendix 7 of the Rules *(1/1/2017)*

All the requirements of this Appendix are cross referenced to the applicable Chapters, Sections or paragraphs of the IGF Code, as appropriate.

1.1.6 Certificate of Fitness *(1/1/2017)*

The responsibility for interpretation of the IGF Code requirements for the purpose of issuing an International Certificate of Fitness for the Gas-fuelled Ships lies with the Administration of the state whose flag the ship is entitled to fly.

Whenever the Society is authorised by an Administration to issue on its behalf the "Certificate of Fitness for the Gas-Fuelled ships", or where the Society is authorised to carry out investigations and surveys on behalf of an Administration on the basis of which the "Certificate of Fitness for the Gas-Fuelled ships " will be issued by the Society, or where the Society is requested to certify compliance with the IGF Code, the full compliance with the requirements of the IGF Code, including the operative requirements mentioned in [1.1.4], is to be granted by the Administration.

1.2 Documentation to be submitted

1.2.1 *(1/1/2017)*

Tab 1 lists the plans, information, analysis, etc. which are to be submitted in addition to the information required in the other Parts of the Rules for the parts of the ship not affected by the cargo, as applicable.

SECTION 1 GENERAL

1 Application

1.1 General

1.1.1 The requirements of this Chapter apply to electrical installations on ships. In particular, they apply to the components of electrical installations for:

- primary essential services
- secondary essential services
- essential services for special purposes connected with ships specifically intended for such purposes (e.g. cargo pumps on tankers, cargo refrigerating systems, air conditioning systems on passenger ships)
- services for habitability.

The other parts of the installation are to be so designed as not to introduce any risks or malfunctions to the above services.

1.1.2 *(1/7/2007)*

As stated in Note 1 to Pt A, Ch 1, Sec 1, [1.1.2], the statutory requirements of the SOLAS Convention and/or national safety regulations, as applicable, regarding fire protection, detection and extinction (hereinafter referred to as "fire protection statutory requirements") are no longer mandatory for the purpose of classification, except where the Society carries out surveys relevant to fire protection statutory requirements on behalf of the flag Administration. In such cases, fire protection statutory requirements are considered a matter of class and therefore compliance with these requirements is also verified by the Society for classification purposes.

1.1.3 *(1/7/2019)*

The Society may consider modified requirements for installations of ships having navigation notation "sheltered area" or "special navigation" in an area at not more than 6 miles from the shore.

1.2 References to other regulations and standards

1.2.1 The Society may refer to other regulations and standards when deemed necessary. These include the IEC publications, notably the IEC 60092 series.

1.2.2 When referred to by the Society, publications by the International Electrotechnical Commission (IEC) or other internationally recognised standards, are those currently in force at the date of agreement for ship classification.

2 Documentation to be submitted

2.1

2.1.1 The documents listed in Tab 1 are to be submitted.

The list of documents requested is to be intended as guidance for the complete set of information to be submitted, rather than an actual list of titles.

The Society reserves the right to request the submission of additional documents in the case of non-conventional design or if it is deemed necessary for the evaluation of the system, equipment or components.

Unless otherwise agreed with the Society, documents for approval are to be sent in triplicate if submitted by the Shipyard and in four copies if submitted by the equipment supplier.

Documents requested for information are to be sent in duplicate.

In any case, the Society reserves the right to require additional copies when deemed necessary.

2.1.2 *(1/7/2021)*

In addition to the documentation listed in Tab 1, a FMEA, carried out according to the RINA "Guide for Failure mode and Effect Analysis" or other equivalent methods, and a Test Program, identifying the tests to be carried out in order to verify the assumptions and conclusions of the FMEA, may be requested for approval for the following systems where applicable (see Note 1):

- control and power systems to power-operated fire doors and status indication for all fire doors;
- control and power systems to power-operated watertight doors and their status indication;
- steering gear control system;
- electric propulsion control system;
- public address and general alarm system;
- remote emergency stop/shutdown arrangements for systems which may support the propagation of fire and/or explosion;
- control and power system and position indication circuits for bow doors, stern doors, side doors, inner doors.

The FMEA may be requested by the Society for other systems on a case by case basis, depending on their influence on the overall ship safety.

Note 1: where the modes of failure and their consequences are clearly identifiable from the relevant drawings the Society may waive this request.

2.1.3 *(1/7/2021)*

Where the Society carries out surveys relevant to fire protection statutory requirements on behalf of the flag Administration (see [1.1.2]) the additional documents listed in Tab 2 are to be submitted.

2.1.4 *(1/7/2021)*
When an alteration or addition to an existing installation is proposed, updated plans are to be submitted for approval. As a minimum a technical specification, schematic diagrams and a proposed list of tests to be carried out onboard at the presence of the RINA Surveyor are to be included.

2.1.5 *(1/7/2021)*
Where computer based systems are implemented and used to control the electrical installation, or to provide safety functions in accordance with the requirements of this Chapter (e.g. electric propulsion, steering gear, emergency safety systems etc.), the arrangements are to satisfy the applicable requirements of Chapter 3.

3 Definitions

3.1 General

3.1.1 Unless otherwise stated, the terms used in this Chapter have the definitions laid down by the IEC standards.

The definitions given in the following requirements also apply.

3.2 Essential services

3.2.1 Essential services are those services essential for propulsion and steering, and the safety of the ship, and services to ensure minimum comfortable conditions of habitability and necessary for special purposes connected with ships specifically intended for such purposes (e.g. cargo pumps on tankers, cargo refrigerating systems, air conditioning systems on passenger ships).

Table 1 : Documents to be submitted *(1/1/2023)*

No.	I/A **(1)**	Documents to be submitted	Notes
		GENERAL	
1	A	Operation description of main, emergency and transitional electrical power systems (if applicable) under normal and foreseeable abnormal operating conditions.	
2	A	Single line diagram of main and emergency power and lighting systems.	The drawing is to include the single line diagram of: • the main switchboard and all the feeders connected to the main switchboard • the emergency switchboard and all feeders connected to the emergency switchboard • interconnector feeder between main switchboard and emergency switchboard • the main and emergency source of electrical power (i.e. generators and/or batteries and any additional source of power) • any distribution boards and motor control centers (MCC) • the main and emergency lighting distribution • transformers, converters and similar appliance which constitute an essential part of the electrical supply system • uninterruptible power system units (UPS) when providing an alternative power supply to essential services and/or when providing an alternative power supply or transitional power supply, if any, to the emergency services.
3	A	Electrical power balance (main and emergency supply).	The load balance of the main supply is to include the operating modes in which the ship is intended to operate.

(1) A: to be submitted for approval
I: to be submitted for information

No.	I/A (1)	Documents to be submitted	Notes
4	I	Calculation of short-circuit currents for installation in which the sum of rated power of the energy sources which may be connected contemporaneously to the network is greater than 500 kVA.	The calculation is to include the short circuit currents at: • the main switchboard(s) • the emergency switchboard • all the distribution boards and MCC including those fed from transformers. Document is to include details of circuit breaker and fuse operating times and discrimination curves.
5	A	List of circuits including, for each supply and distribution circuit, data concerning the nominal current, the cable type, length and cross-section, nominal and setting values of the protective and control devices.	Main switchboard, emergency switchboards, each distribution board, motor control centers (MCC) and UPS and/or battery distribution.
6	A	Single line diagram and detailed functional diagram of the main switchboard	
7	A	Single line diagram and detailed functional diagram of the emergency switchboard.	
8	A	Single line diagram and detailed functional diagram of distribution boards, and 100kW and over motor control centers and single starters.	Main distribution boards are intended as distribution boards which are supplied directly or through transformer by main or emergency switchboard
9	A	Diagram and arrangement of main and emergency lighting	
10	A	Diagram and arrangement of the general emergency alarm system, the public address system and other intercommunication systems.	
11	A	A functional diagram of the distribution board specially reserved for the navigation lights.	
12	I	Schedule for recording of the type, location and maintenance cycle of batteries used for essential and emergency services.	Reference is to be made to the requirements of Sec 3, [11.1.1].
13	A	Single line diagram for electric propulsion installation, including power supply circuits.	For control alarm and safety system see Chapter 3.
14	A/I	For BATTERY POWERED SHIP documents required by App 2, Tab 1 and for FUEL CELL POWERED SHIP, documents required by App 3, Tab 1.	
15	A	A functional diagram of the electric power circuits for steering gear	Reference is to be made to the requirements of Ch 1, Sec 11, [2.3], [2.4], [3] & [4]. For control alarm and safety system see Chapter 3
16	A	Electrical diagram of local application fixed gas fire-extinguishing systems.	Reference is to be made to the requirements of Ch 4, Sec 1, [7.1.2]
17	A	Electrical diagrams of power control and position indication circuits of watertight doors	Reference is to be made to the requirements of: • Pt B, Ch 2, Sec 1, [6] • Pt E, Ch 11, Sec 2

(1) A: to be submitted for approval
I: to be submitted for information

SECTION 3 SYSTEM DESIGN

1 Supply systems and characteristics of the supply

1.1 Supply systems

1.1.1 The following distribution systems may be used:

a) on d.c. installations:
- two-wire insulated
- two-wire with one pole earthed

b) on a.c. installations:
- three-phase three-wire with neutral insulated
- three-phase three-wire with neutral directly earthed or earthed through an impedance
- three-phase four-wire with neutral directly earthed or earthed through an impedance
- single-phase two-wire insulated
- single-phase two-wire with one phase earthed.

1.1.2 Distribution systems other than those listed in [1.1.1] (e.g. with hull return, three-phase four-wire insulated) will be considered by the Society on a case by case basis.

1.1.3 The hull return system of distribution is not to be used for power, heating or lighting in any ship of 1600 tons gross tonnage and upwards.

1.1.4 The requirement of [1.1.3] does not preclude under conditions approved by the Society the use of:

a) impressed current cathodic protective systems,

b) limited and locally earthed systems, or

c) insulation level monitoring devices provided the circulation current does not exceed 30 mA under the most unfavourable conditions.

Note 1: Limited and locally earthed systems such as starting and ignition systems of internal combustion engines are accepted provided that any possible resulting current does not flow directly through any dangerous spaces.

1.1.5 For the supply systems of ships carrying liquid developing combustible gases or vapours, see Pt E, Ch 7, Sec 5, Pt E, Ch 8, Sec 10 or Pt E, Ch 9, Sec 10.

1.1.6 For the supply systems in HV Installations, see Sec 13.

1.2 Maximum voltages

1.2.1 The maximum voltages for both alternating current and direct current low-voltage systems of supply for the ship's services are given in Tab 1.

Table 1 : Maximum voltages for various ship services

Use		Maximum voltage, in V
For permanently installed and connected to fixed wiring	Power equipment	1000
	Heating equipment (except in accommodation spaces)	500
	Cooking equipment	500
	Lighting	250
	Space heaters in accommodation spaces	250
	Control **(1)**, communication (including signal lamps) and instrumentation equipment	250
For permanently installed and connected by flexible cable	Power and heating equipment, where such connection is necessary because of the application (e.g. for moveable cranes or other hoisting gear)	1000
For socket-outlets supplying	Portable appliances which are not hand-held during operation (e.g. refrigerated containers) by flexible cables	1000
	Portable appliances and other consumers by flexible cables	250
	Equipment requiring extra precaution against electric shock where an isolating transformer is used to supply one appliance **(2)**	250
	Equipment requiring extra precaution against electric shock with or without a safety transformer **(2)**.	50

(1) For control equipment which is part of a power and heating installation (e.g. pressure or temperature switches for starting/stopping motors), the same maximum voltage as allowed for the power and heating equipment may be used provided that all components are constructed for such voltage. However, the control voltage to external equipment is not to exceed 500 V.

(2) Both conductors in such systems are to be insulated from earth.

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2.3.14 *The transitional source of emergency electrical power where required by* [2.3.12] (item c) *shall consist of an accumulator battery which shall operate without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage and be so arranged as to supply automatically in the event of failure of either the main or the emergency source of electrical power for half an hour at least the services in* [3.7.7] *if they depend upon an electrical source for their operation.*

2.3.15 For the emergency source of electrical power in passenger ships, see Pt E, Ch 11, Sec 5.

2.3.16 *(1/1/2022)*

When the emergency generator room ventilation system is fitted with closable ventilation louvers and ventilator closing appliances, the following requirements apply:

a) ventilation louvers and closing appliances may either be hand-operated or power-operated (hydraulic / pneumatic / electric) and are to be operable under a fire condition;

b) hand-operated ventilation louvers and closing appliances are to be kept open during normal operation of the vessel. Corresponding instruction plates are to be provided at the location where hand-operation is provided;

c) power-operated ventilation louvers and closing appliances are to be of a fail-to-open type. Closed power-operated ventilation louvers and closing appliances are acceptable during normal operation of the vessel;

d) power-operated ventilation louvers and closing appliances are to open automatically whenever the emergency generator is starting / in operation;

e) it is to be possible to close ventilation openings by a manual operation from a clearly marked safe position outside the space, where the closing operation can be easily confirmed. The louver status (open / closed) shall be indicated at this position. Such closing shall not be possible from any other remote position.

2.4 Use of emergency generator in port

2.4.1 To prevent the generator or its prime mover from becoming overloaded when used in port, arrangements are to be provided to shed sufficient non-emergency loads to ensure its continued safe operation.

2.4.2 The prime mover is to be arranged with fuel oil filters and lubrication oil filters, monitoring equipment and protection devices as requested for the prime mover for main power generation and for unattended operation.

2.4.3 The fuel oil supply tank to the prime mover is to be provided with a low level alarm, arranged at a level ensuring sufficient fuel oil capacity for the emergency services for the period of time as required in [3.7].

2.4.4 The prime mover is to be designed and built for continuous operation and should be subjected to a planned maintenance scheme ensuring that it is always available and capable of fulfilling its role in the event of an emergency at sea.

2.4.5 Fire detectors are to be installed in the location where the emergency generator set and emergency switchboard are installed.

2.4.6 Means are to be provided to readily change over to emergency operation.

2.4.7 Control, monitoring and supply circuits for the purpose of the use of the emergency generator in port are to be so arranged and protected that any electrical fault will not influence the operation of the main and emergency services.

When necessary for safe operation, the emergency switchboard is to be fitted with switches to isolate the circuits.

2.4.8 Instructions are to be provided on board to ensure that, even when the vessel is underway, all control devices (e.g. valves, switches) are in a correct position for the independent emergency operation of the emergency generator set and emergency switchboard.

These instructions are also to contain information on the required fuel oil tank level, position of harbour/sea mode switch, if fitted, ventilation openings, etc.

3 Distribution

3.1 Earthed distribution systems

3.1.1 System earthing is to be effected by means independent of any earthing arrangements of the non-current-carrying parts.

3.1.2 Means of disconnection are to be fitted in the neutral earthing connection of each generator so that the generator may be disconnected for maintenance or insulation resistance measurements.

3.1.3 Generator neutrals may be connected in common, provided that the third harmonic content of the voltage wave form of each generator does not exceed 5%.

3.1.4 Where a switchboard is split into sections operated independently or where there are separate switchboards, neutral earthing is to be provided for each section or for each switchboard. Means are to be provided to ensure that the earth connection is not removed when generators are isolated.

3.1.5 Where for final sub-circuits it is necessary to locally connect a pole (or phase) of the sub-circuits to earth after the protective devices (e.g. in automation systems or to avoid electromagnetic disturbances), provision (e.g. d.c./d.c. convertors or transformers) is to be made such that current unbalances do not occur in the individual poles or phases.

3.1.6 For high voltage systems see Sec 13.

The calculation results and validity of the guidance provided are to be verified by the surveyor during sea trials.

Note 1: harmonic filters installed for single application frequency drives, such as pump motors, may be excluded from requirements of [3.5].

3.6 Main distribution of electrical power

3.6.1 Where the main source of electrical power is necessary for propulsion of the ship, the main busbar is to be divided into at least two parts which are normally to be connected by circuit breakers or other approved means such as circuit breakers without tripping mechanisms or disconnecting links or switches by means of which busbars can be split safely and easily.

The connection of generating sets and associated auxiliaries and other duplicated equipment is to be equally divided between the parts as far as practicable, so that in the event of damage to one section of the switchboard the remaining parts are still supplied.

3.6.2 *(1/1/2021)*

Two or more units serving the same consumer (e.g. main and standby lubricating oil pumps) are to be supplied by individual separate circuits without the use of common feeders, protective devices or control circuits.

This requirement is satisfied when such units are supplied by separate cables from the main switchboard or from two independent distribution boards.

3.6.3 *A main electric lighting system which shall provide illumination throughout those parts of the ship normally accessible to and used by (passengers or) crew shall be supplied from the main source of electrical power.*

3.7 Emergency distribution of electrical power

3.7.1 *The emergency switchboard shall be supplied during normal operation from the main switchboard by an interconnector feeder which shall be adequately protected at the main switchboard against overload and short-circuit and which is to be disconnected automatically at the emergency switchboard upon failure of the main source of electrical power.*

Where the system is arranged for feedback operation, the interconnector feeder is also to be protected at the emergency switchboard at least against short-circuit.

3.7.2 *In order to ensure ready availability of the emergency source of electrical power, arrangements shall be made where necessary to disconnect automatically non-emergency circuits from the emergency switchboard to ensure that power shall be available to the emergency circuits.*

3.7.3 *(1/1/2023)*

The emergency source of electrical power shall be capable of supplying simultaneously at least the following services for the periods specified hereafter, if they depend upon an electrical source for their operation:

a) for a period of 3 hours, emergency lighting at every muster and embarkation station and over the sides;

b) for a period of 18 hours, emergency lighting:

1) in all service and accommodation alleyways, stairways and exits, personnel lift cars and personnel lift trunks;

2) in the machinery spaces and main generating stations including their control positions;

3) in all control stations, machinery control rooms, and at each main and emergency switchboard;

4) at all stowage positions for firemen's outfits;

5) at the steering gear;

6) at the fire pump referred to in (e) below, at the sprinkler pump, if any, at the emergency bilge pump, if any, and at the starting positions of their motors; and

7) in all cargo pump-rooms of tanker

c) for a period of 18 hours:

1) the navigation lights and other lights required by the International Regulations for Preventing Collisions at Sea in force;

2) on ships constructed on or after 1 February 1995 the VHF radio installation required by Regulation IV/7.1.1 and IV/7.1.2 of SOLAS Consolidated Edition 1992, and, if applicable:

- *the MF radio installation required by Regulations IV/9.1.1, IV/9.1.2, IV/10.1.2 and IV/10.1.3;*
- *the ship earth station required by Regulation IV/10.1.1; and*
- *the MF/HF radio installation required by Regulations IV/10.2.1, IV/10.2.2 and IV/11.1;*

d) for a period of 18 hours:

1) all internal communication equipment as required in an emergency [3.7.4]*;*

2) the shipborne navigational equipment as required by Regulation V/19; where such provision is unreasonable or impracticable the Society may waive this requirement for ships of less than 5 000 tons gross tonnage;

3) the fire detection and fire alarm systems (see Sec 1, [1.1.2]); and

4) intermittent operation of the daylight signalling lamp, the ship's whistle, the manually operated call points and all internal signals (see [3.7.5]) *that are required in an emergency~~, unless such services have an independent supply for the period of 18 hours from an accumulator battery suitably located for use in an emergency~~;*

unless such services have an independent supply for the period of 18 hours from an accumulator battery suitably located for use in an emergency;

e) for a period of 18 hours: one of the fire pumps, when required, if dependent upon the emergency generator for its source of power (see Sec 1, [1.1.2]);

f) for the period of time required in Ch 1, Sec 11, [2], *the steering gear where it is required to be so supplied.*

Note 1: for ships having navigation notation "sheltered area" or "special navigation" in an area at not more than 6 miles from the shore (see Sec 1, [1.1.3]) and not subject to the SOLAS convention, the Society may accept that the emergency source of electrical

SECTION 7 STORAGE BATTERIES, CHARGERS ~~AND~~, UNINTERRUPTIBLE POWER SYSTEMS AND FUEL CELLS

1 Constructional requirements for batteries

1.1 General

1.1.1 The requirements of this ~~Section~~Article apply to permanently installed storage batteries (not to portable batteries).

1.1.2 *(1/1/2019)*

Storage batteries may be of the lead-acid or nickel-alkaline type, due consideration being given to the suitability for any specific application.

The use of batteries other than Lead-acid or alkaline batteries is allowed subject to the compliance of the battery system and its installation to the requirements given in App 2.

Storage batteries of satisfactorily proven design (e.g. silver/zinc) may be accepted provided they are suitable for shipboard use to the satisfaction of the Society.

1.1.3 Cells are to be assembled in suitable crates or trays equipped with handles for convenient lifting.

1.2 Vented batteries

1.2.1 Vented batteries are those in which the electrolyte can be replaced and freely releases gas during periods of charge and overcharge.

1.2.2 Vented batteries are to be constructed to withstand the movement of the ship and the atmosphere (salt mist, oil etc.) to which they may be exposed.

1.2.3 Battery cells are to be so constructed as to prevent spilling of electrolyte at any inclination of the battery up to 40° from the vertical.

1.2.4 It is to be possible to check the electrolyte level and the pH.

1.3 Valve-regulated sealed batteries

1.3.1 Valve-regulated sealed batteries are batteries whose cells are closed under normal conditions but which have an arrangement which allows the escape of gas if the internal pressure exceeds a predetermined value. The cells cannot normally receive addition to the electrolyte.

Note 1: The cells of batteries which are marketed as "sealed" or "maintenance free" are fitted with a pressure relief valve as a safety precaution to enable uncombined gas to be vented to the atmosphere; they should more properly be referred to as valve-regulated sealed batteries. In some circumstances the quantity of gas vented can be up to 25% of the equivalent vented design. The design is to take into consideration provision for proper ventilation.

1.3.2 Cell design is to minimise risks of release of gas under normal and abnormal conditions.

1.4 Tests on batteries

1.4.1 The battery autonomy is to be verified on board in accordance with the operating conditions.

2 Constructional requirements for chargers

2.1 Characteristics

2.1.1 Chargers are to be adequate for the batteries for which they are intended and provided with a voltage regulator.

2.1.2 In the absence of indications regarding its operation, the battery charger is to be such that the completely discharged battery can be recharged to 80% capacity within a period of 10 hours without exceeding the maximum permissible charging current. A charging rate other than the above (e.g. fully charged within 6 hours for batteries for starting of motors) may be required in relation to the use of the battery.

2.1.3 For floating service or for any other condition where the load is connected to the battery while it is on charge, the maximum battery voltage is not to exceed the safe value of any connected apparatus.

Note 1: Consideration is to be given to the temperature variation of the batteries.

2.1.4 The battery charger is to be designed so that the charging current is set within the maximum current allowed by the manufacturer when the battery is discharged and the floating current to keep the battery fully charged.

2.1.5 Trickle charging to neutralise internal losses is to be provided. An indication is to be provided to indicate a charging voltage being present at the charging unit.

2.1.6 Protection against reversal of the charging current is to be provided.

2.1.7 Battery chargers are to be constructed to simplify maintenance operation. Indications are to be provided to visualise the proper operation of the charger and for troubleshooting.

2.2 Tests on chargers

2.2.1 Battery chargers are to be subjected to tests in accordance with Tab 1.

Type tests are the tests to be carried out on a prototype charger or the first of a batch of chargers, and routine tests are the tests to be carried out on subsequent chargers of a particular type.

2.2.2 *(1/7/2004)*

The tests of battery chargers of 50 kVA and over intended for essential services are to be attended by a Surveyor of the Society.

Note 1: An alternative inspection scheme may be agreed by the Society with the Manufacturer whereby the attendance of the Surveyor will not be required as indicated above.

3 Uninterruptible power system (UPS) units as alternative and/or transitional power

3.1 Application

3.1.1 *(1/1/2023)*

These requirements for UPS units apply when providing an alternative power supply or transitional power supply to services as defined in Pt E, Ch 11, Sec 5, [2]~~SOLAS II-1/42~~ and Sec 3, [2.3] and [3.7]~~SOLAS II-1/43~~ and when providing an alternative power supply to primary essential services as defined in Sec 1, [3.3.1].

A UPS unit complying with these requirements may provide an alternative power supply as an accumulator battery in terms of being an independent power supply for services defined in Pt E, Ch 11, Sec 5, [2.2.3]~~SOLAS II-1/42.2.3~~ or Sec 3, [3.7.3] d)~~SOLAS II-1/43.2.4~~ and primary essential services as defined in Sec 1, [3.3.1].

3.2 Definitions

3.2.1 *(1/7/2006)*

Uninterruptible Power System (UPS) - combination of convertors, switches and energy storage means, for example batteries, constituting a power system for maintaining continuity of load power in case of input power failure

Off-line UPS unit - a UPS unit where under normal operation the output load is powered from the bypass line (raw mains) and only transferred to the inverter if the bypass supply fails or goes outside preset limits. This transition will invariably result in a brief (typically 2 to 10 ms) break in the load supply.

Line interactive UPS unit - an off-line UPS unit where the bypass line switches to stored energy power when the input power goes outside the preset voltage and frequency limits.

On-line UPS unit - a UPS unit where, under normal operation, the output load is powered from the inverter and will therefore continue to operate without a break in the event of the supply input failing or going outside preset limits.

3.3 Design and construction

3.3.1 *(1/7/2022)*

UPS units are to be constructed in accordance with IEC 62040-1, IEC 62040-2, IEC 62040-3, IEC 62040-4 and/or IEC 62040-5-3, as applicable, or an acceptable and relevant national or international standard.

3.3.2 *(1/7/2006)*

The operation of the UPS is not to depend upon external services.

3.3.3 *(1/7/2006)*

The type of UPS unit employed, whether off-line, line interactive or on-line, is to be appropriate to the power supply requirements of the connected load equipment.

3.3.4 *(1/7/2006)*

An external bypass is to be provided.

3.3.5 *(1/7/2006)*

The UPS unit is to be monitored and audible and visual alarm is to be given in a normally attended location for:

- power supply failure (voltage and frequency) to the connected load,
- earth fault,
- operation of a battery protective device,
- when the battery is being discharged, and
- when the bypass is in operation for on-line UPS units.

3.4 Location

3.4.1 *(1/1/2023)*

The UPS unit providing an alternative power supply or transitional power supply to services as defined in Pt E, Ch 11, Sec 5, [2] and Sec 3, [2.3] and [3.7]~~SOLAS Chapter II-1, Regulations 42 and 43~~ is to be suitably located for use in an emergency.

3.4.2 *(1/7/2022)*

UPS units using valve regulated sealed batteries may be located in compartments with normal electrical equipment, provided the ventilation arrangements are in accordance with the requirements of IEC 62040-1, IEC 62040-2, IEC 62040-3, IEC 62040-4 and/or IEC 62040-5-3, as applicable, or an acceptable and relevant national or international standard.

3.5 Performance

3.5.1 *(1/7/2022)*

The output power is to be maintained for the duration required for the connected emergency services as stated in SOLAS II-1/42 or SOLAS II-1/43.

3.5.2 *(1/7/2006)*

No additional circuits are to be connected to the UPS unit without verification that the latter has adequate capacity. The UPS battery capacity is, at all times, to be capable of supplying the designated loads for the time specified in the regulations.

3.5.3 *(1/7/2006)*

On restoration of the input power, the rating of the charge unit is to be sufficient to recharge the batteries while maintaining the output supply to the load equipment.

3.6 Testing and survey

3.6.1 *(1/7/2006)*

UPS units of 50 kVA and over are to be surveyed by the Society during manufacturing and testing.

3.6.2 *(1/7/2006)*

Appropriate testing is to be carried out to demonstrate that the UPS unit is suitable for its intended environment. This is expected to include, as a minimum, the following tests:

- Functionality, including operation of alarms;
- Temperature rise;
- Ventilation rate;
- Battery capacity.

3.6.3 *(1/7/2006)*

Where the supply is to be maintained without a break following a power input failure, this is to be verified after installation by means of a practical test.

Table 1 : Tests to be carried out on battery chargers

No.	Tests	Type test **(1)**	Routine test **(2)**
1	Examination of the technical documentation, as appropriate, and visual inspection **(3)** including check of earth continuity	X	X
2	Functional tests (current and voltage regulation, quick, slow, floating charge, alarms)	X	X
3	Temperature rise measurement	X	
4	Insulation test (dielectric strength test and insulation resistance measurement)	X	X

(1) Type test on prototype battery charger or test on at least the first batch of battery chargers.

(2) The certificates of battery chargers routine tested are to contain the manufacturer's serial number of the battery charger which has been type tested and the test result.

(3) A visual examination is to be made of the battery charger to ensure, as far as practicable, that it complies with technical documentation.

4 Fuel cells

4.1 General

4.1.1 *(1/1/2023)*

The requirements of this Article apply to fuel cells installed on board.

4.1.2 *(1/1/2023)*

The use of fuel cells is allowed subject to the compliance of the fuel cell power installation to the requirements given in App 3.

APPENDIX 3 FUEL CELL POWERED SHIPS

1 General

1.1 Scope

1.1.1 Application *(1/1/2023)*

The provisions of this Appendix apply to the arrangement, installation, control, monitoring and safety systems of ships using fuel cell power installations. These Rules are applicable to installations with several different configurations of fuel cell power installations. Since the fuel cell is a novel technology under continuous development, additional requirements to those specified in these Rules may be required by RINA on a case-by-case basis depending on the design principles of the fuel cell in subject. Where the fuel cell power installations consist of the fuel cell power systems which are enclosed in modules, the RINA "Rules for the Type Approval of Fuel Cell Power Modules" apply in conjunction with this Appendix.

1.1.2 Acceptance by the flag Administration *(1/1/2023)*

The use of fuel cells on ships requires acceptance by the Administration of the State whose flag the ship is entitled to fly.

1.1.3 MSC.1/Circ.1647 requirements and the Society's rules *(1/1/2023)*

For fuel cell powered ships, the requirements of the IMO Interim Guidelines for the Safety of Ships using Fuel Cell Power Installations set out in the annex of IMO circular MSC.1/Circ.1647 (hereinafter named "MSC.1/Circ.1647") are to be applied as class requirements as specified and with the deviations given in this Appendix.

For the scope of classification, when reference is made to paragraphs of MSC.1/Circ.1647 where the wording "Administration" is used, it is to be regarded as referring to the "Society".

In general, this Appendix applies to fuel cell power installations and to their interfaces with the other ship systems. Unless otherwise specified, the machinery, equipment and systems of fuel cell powered ships are also to comply with the requirements given in Part C.

The fuel cell power installations designed to use low-flashpoints fuels as primary fuel (e.g. LNG, LPG, NH3, methyl/ethyl alcohol, hydrogen) are additionally to comply with the following requirements, as applicable:

- Ch 1, App 7 (LNG or CNG Fuelled Ships)
- Ch 1, App 13 (LPG or NH3 Fuelled Ships)
- Ch 1, App 14 (Hydrogen Fuelled Ships)
- Ch 1, App 15 (Methyl/Ethyl Alcohol Fuelled Ships).

The electrical equipment needed for the conditioning of the electrical output from the fuel cell power installation such as e-filters, inverters, converters and transformers are to comply with Ch 2, Sec 5 and Sec 6. The reforming equipment as well auxiliary systems are to comply with Ch 1, Sec 3 and Ch 1, Sec 10.

1.1.4 MSC.1/Circ.1647 requirements not within the scope of classification *(1/1/2023)*

The following requirements of MSC.1/Circ.1647 are not within the scope of classification:

- Section 3 - Fire Safety

These requirements are applied by the Society when acting on behalf of the flag Administration, within the scope of delegation (see [1.1.6]).

1.1.5 Correspondence of the MSC.1/Circ.1647 with the Rules *(1/1/2023)*

All the requirements of this Appendix are cross referenced to the applicable paragraphs of MSC.1/Circ.1647, as appropriate.

1.1.6 Statutory certificates *(1/1/2023)*

The responsibility for interpretation of the MSC.1/Circ.1647 requirements for the purpose of issuing statutory certificates for fuel cell powered ships lies with the Administration of the State whose flag the ship is entitled to fly.

Whenever the Society is authorized by an Administration to issue on its behalf the statutory certificates for fuel cell powered ships, or where the Society is authorized to carry out investigations and surveys on behalf of an Administration on the basis of which the statutory certificates for fuel cell powered ships will be issued by the Administration, or where the Society is requested to certify compliance with MSC.1/Circ.1647, the full compliance with the requirements of MSC.1/Circ.1647, including the fire safety requirements mentioned in [1.1.4], will be granted by the Society, subject to [1.1.2].

1.1.7 FUEL CELL POWERED SHIP additional class notation *(1/1/2023)*

The **FUEL CELL POWERED SHIP** additional class notation is assigned to ships where fuel cells are installed to supply essential or not-essential services, in compliance with the design and constructional requirements of this Appendix, as follows:

- **FUEL CELL POWERED SHIP (E)** when fuel cell is used to power at least one of the essential services defined in Ch 2, Sec 1, [3.2.1] and is necessary to ensure the compliance of the main source of electrical power to the requirements in Ch 2, Sec 3, [2.2.3]
- **FUEL CELL POWERED SHIP (NE)** when fuel cell is used to power only services not falling under the definition of essential services in Ch 2, Sec 1, [3.2.1].

1.2 Documentation to be submitted

1.2.1 *(1/1/2023)*

Tab 1 lists the plans, information, analysis, etc. which are to be submitted in addition to the information required in the

other Parts of the Rules, for the portion of the ship not involved in fuel cell power installations.

The Society reserves the right to request the submission of additional documents in the case of non-conventional design or if it is deemed necessary for the evaluation of the system, equipment or components.

Table 1 : Documents to be submitted

No.	I/A (1)	Document
1	I	Technical specification of the fuel cell power installation, including technical data as power output parameters including min./max. design voltage and current, information about min/max temperature/pressure/rate of process air/cooling water/ventilation.
2	I	List of mechanical and electrical components which are part of the fuel cell power installation with specification of the pumps, compressors and fans.
3	A	P&I diagrams of systems conveying fuel (primary and reformed type), exhaust air/gas, cooling media, process air, technical water, ventilation, inerting and of other systems in the fuel cell power installation.
4	I	Description of thermal insulation and heat tracing, if any.
5	A	Construction details with strength analysis of fuel cell power installation frame and foundation, if any.
6	A	Construction drawings of all components of the reforming equipment considered as pressure vessel e.g. burner, reformer, heat exchangers.
7	I	Functional description of the fuel cell power installation including at least its design, safety principles, ventilation and gas detection concept, auxiliary systems arrangement (e.g. cooling medium, process air, ventilation, venting, process water, inert gas, as applicable).
8	A	Block diagram of the safety, control and monitoring system of the fuel cell power installation.
9	A	Wiring diagrams of power supply and automation system of the fuel cell power installation.
10	I	List of controlled and monitored parameters and cause and effect matrix with normal/emergency shutdown functions.
11	A	Hazardous zones categorization study with calculation according to IEC 60079-10 (using CFD simulations or empirical formula) and list of EX equipment with relevant EX certificates, as applicable.
12	A	Service profile description of the fuel cell power installations, highlighting if the fuel cell power generation is used for essential or non-essential ship services.
13	I	A FMEA according to the RINA "Guide for Failure mode and Effect Analysis" or other equivalent methods for the fuel cell power installation.
14	I	Lifecycle operational, maintenance and inspection manual of the fuel cell power installation.
15	I	Testing reports or type approval reference of the fuel cell power installation components such as fuel cell stacks, reforming equipment according to applicable international recognized standards.

(1) A = to be submitted for approval
I = to be submitted for information

1.3 Definitions

MSC.1/Circ.1647 REFERENCE: para. 1.4

1.3.1 *(1/1/2023)*

The terms used in this Appendix have the meanings defined in MSC.1/Circ.1647, para. 1.4 and in the RINA "Rules for the Type Approval of Fuel Cell Power Modules".

Terms not defined have the same meaning as in SOLAS chapter II-2 and the IGF Code.

1.3.2 *(1/1/2023)*

Certified safe type: means electrical equipment that is certified safe by the relevant recognized authorities for operation in a flammable atmosphere based on a recognized standard.

Note 1: Refer to IEC 60079 series, Explosive atmospheres and IEC 60092-502:1999 Electrical Installations in Ships - Tankers - Special Features.

1.3.3 *(1/1/2023)*

Fuel cell power module: is the fuel cell power system or parts of fuel cell power system and relevant enclosure.

1.3.4 *(1/1/2023)*

Fuel cell module: is the assembly incorporating one or more fuel cell stacks and auxiliary systems.

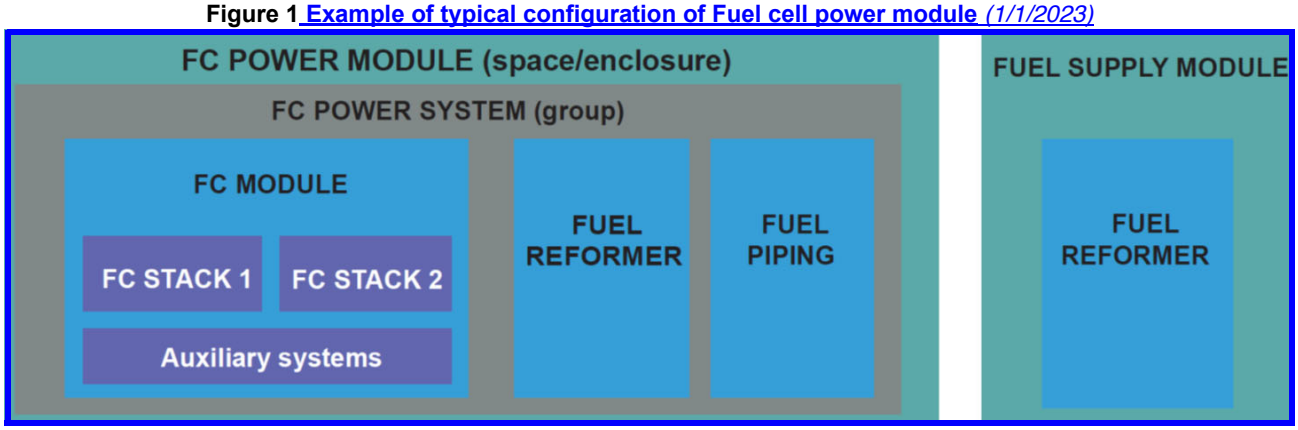
1.3.5 *(1/1/2023)*

Fuel supply module: is the enclosure containing the fuel reforming and fuel conditioning equipment.

1.3.6 *(1/1/2023)*

Service profile: is a description of the use of the fuel cell for the power supply to on-board systems considering the operational profile of the ship (navigation, maneuvering and port stay).

Figure 1 Example of typical configuration of Fuel cell power module *(1/1/2023)*



2 Goal and functional requirements

MSC.1/Circ.1647 REFERENCE: para. 1.2 and 1.3

2.1 Goal

2.1.1 *(1/1/2023)*

The goal of this Appendix is to provide for safe and reliable delivery of electrical and/or thermal energy through the use of fuel cell technology.

2.2 Functional requirements

2.2.1 *(1/1/2023)*

The safety, reliability and dependability of the systems is to be equivalent to that achieved with new and comparable conventional oil-fuelled main and auxiliary machinery installations, regardless of the specific fuel cell type and fuel.

A FMEA consistent with the RINA "Guide for Failure Mode and Effect Analysis" is to be carried out for the whole fuel cell power installation to check the potential existence of failure modes that can jeopardize the ship's safety. The results of the FMEA are then to be used to establish a trial program.

2.2.2 *(1/1/2023)*

The probability and consequences of fuel-related hazards are to be limited to a minimum through arrangement and system design, such as ventilation, detection and safety actions. In the event of gas leakage or failure of the risk reducing measures, necessary safety actions are to be initiated.

2.2.3 *(1/1/2023)*

The design philosophy is to ensure that risk reducing measures and safety actions for the fuel cell power installation do not lead to an unacceptable loss of power.

2.2.4 *(1/1/2023)*

Hazardous areas are to be restricted, as far as practicable, to minimize the potential risks that might affect the safety of the ship, persons on board, and equipment.

2.2.5 *(1/1/2023)*

Equipment installed in hazardous areas are to be minimized to that required for operational purposes and are to be suitably and appropriately certified.

2.2.6 *(1/1/2023)*

Unintended accumulation of explosive, flammable or toxic gas concentrations are to be prevented.

2.2.7 *(1/1/2023)*

System components are to be protected against external damages.

2.2.8 *(1/1/2023)*

Sources of ignition in hazardous areas are to be minimized to reduce the probability of explosions.

2.2.9 *(1/1/2023)*

Piping systems and overpressure relief arrangements that are of suitable design, construction and installation for their intended application are to be provided.

2.2.10 *(1/1/2023)*

Machinery, systems and components are to be designed, constructed, installed, operated, maintained and protected to ensure safe and reliable operation.

2.2.11 *(1/1/2023)*

Fuel cell spaces are to be arranged and located such that a fire or explosion in either will not lead to an unacceptable loss of power or render equipment in other compartments inoperable.

2.2.12 *(1/1/2023)*

Suitable control, alarm, monitoring and shutdown systems are to be provided to ensure safe and reliable operation.

2.2.13 *(1/1/2023)*

Fixed leakage detection suitable for all spaces and areas concerned is to be arranged.

2.2.14 *(1/1/2023)*

Fire detection, protection and extinction measures appropriate to the hazards concerned are to be provided.

2.2.15 *(1/1/2023)*

Commissioning, trials and maintenance of fuel systems and gas utilization machinery are to satisfy the goal in terms of safety, availability and reliability.

2.2.16 *(1/1/2023)*

The technical documentation is to permit an assessment of the compliance of the system and its components with the applicable rules, guidelines, design standards used and the principles related to safety, availability, maintainability and reliability.

2.2.17 *(1/1/2023)*

A single failure in a technical system or component is not to lead to an unsafe or unreliable situation.

The fuel cell power installations that:

- are used to power at least one essential service as defined in Ch 2, Sec 1, [3.2.1], and
- are necessary to ensure the compliance of the main source of electrical power to the requirements in Ch 2, Sec 3, [2.2.3]

are to be specifically considered in terms of reliability, availability and redundancy.

2.2.18 *(1/1/2023)*

Safe access is to be provided for operation, inspection and maintenance.

3 Alternative design

MSC.1/Circ.1647 REFERENCE: para. 1.5

3.1

3.1.1 *(1/1/2023)*

Appliances and arrangements of fuel cell power systems may deviate from those set out in this Appendix provided that they meet the intent of the goal and functional requirements concerned and provide an equivalent level of safety of the relevant paragraphs.

3.1.2 *(1/1/2023)*

The equivalence of the alternative design is to be demonstrated as specified in SOLAS regulation II-1/55, and approved by the Society. However, the Society will not allow operational methods or procedures as an alternative to a particular fitting, material, appliance, apparatus, item of equipment, or type thereof which is prescribed by this Appendix.

4 Design principles for fuel cell power installations

MSC.1/Circ.1647 REFERENCE: para. 2

4.1 Fuel cell spaces

4.1.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 2.1 apply.

4.2 Arrangement and access

4.2.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 2.2 apply.

4.3 Atmospheric control of fuel cell spaces

4.3.1 **General** *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 2.3.1 apply.

4.3.2 **Ventilation of fuel cell spaces** *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 2.3.2 apply.

When applying the requirements in MSC.1/Circ.1647 para. 2.3.2.3, reference is to be made to IEC 60079-10 standard.

4.3.3 **Inerting of fuel cell spaces for fire protection purposes** *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 2.3.3 apply.

4.4 Materials

4.4.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 2.4 apply.

4.4.2 *(1/1/2023)*

The use of plastic materials for piping and pressure vessels is in general not allowed. Specific application may be evaluated on case-by-case basis.

4.5 Piping arrangement for fuel cell power system

4.5.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 2.5 apply.

4.5.2 *(1/1/2023)*

Where the fuel cell stacks are subject to specific air quality requirements (e.g., limits on dust, humidity, salinity, temperature), arrangements for air conditioning, air drying and air filtering are to be fitted and the air quality parameters are to be monitored.

4.5.3 *(1/1/2023)*

Where the primary fuel is subject to specific quality requirements (e.g., maximum Sulphur content) not to impair the performances of the fuel cell power system, arrangements for fuel conditioning system are to be fitted.

4.5.4 *(1/1/2023)*

If enclosed fuel supply modules and enclosed fuel cell modules are installed, they are to be fitted with sampling point connections for detecting explosive atmosphere by means of portable equipment.

4.5.5 *(1/1/2023)*

Where the pressure vessels and the piping in the fuel cell power module may be subject to overpressure, they are to be suitably protected by pressure relief arrangements. The discharge of possible hazardous gases is to be routed to open air.

4.6 Exhaust gas and exhaust air

4.6.1 *(1/1/2023)*

Exhaust gases and exhaust air from the fuel cell power systems should not be combined with any ventilation and should be led to a safe location in the open air.

4.6.2 *(1/1/2023)*

The arrangement of the process air treatment system is to be subject to the risk assessment as required in [6.3].

5 Fire safety

MSC.1/Circ.1647 REFERENCE: para. 3

5.1

5.1.1 *(1/1/2023)*

This paragraph is void, as the provisions of MSC.1/Circ.1647 para. 3 are not within the scope of classification.

These provisions are applied by the Society when acting on behalf of the flag Administration, within the scope of delegation (see [1.1.6]).

6 Electrical systems

MSC.1/Circ.1647 REFERENCE: para. 4

6.1 General provisions on electrical systems

6.1.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 4.1 apply.

6.1.2 *(1/1/2023)*

For the casing of the fuel cell stack to be mounted in the fuel cell space, a minimum enclosure notation of IP54 is required to protect against:

a) ingress of dust in sufficient quantity to interfere with satisfactory operation of the fuel cell; and

b) water splashed against the fuel cell stack from any direction.

6.1.3 *(1/1/2023)*

The equipment and installations in hazardous areas are to comply with recognized international standards including but not limited to the following:

- IEC 60079-0 General requirements
- IEC 60079-1 Flameproof enclosure 'Ex d'
- IEC 60079-7 Increased safety 'Ex e'
- IEC 60079-11 Intrinsic safety 'Ex i'
- IEC 60079-14 Installations
- IEC 60079-17 Electrical Installations inspection and maintenance
- IEC 60079-18 Molded encapsulation 'Ex m'
- IEC 60079-25 Intrinsically safe systems
- IEC 60079-29 Gas detection

The equipment is to be properly EX certified considering the hazardous zone categorization defined by manufacturer according to IEC 60079-10 or according to [6.2].

6.1.4 *(1/1/2023)*

Earthing and bonding are to be arranged according to recognized international standards.

6.2 Area classification

6.2.1 General *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 4.2.1 apply.

6.2.2 Hazardous areas zone 0 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 4.2.2 apply.

6.2.3 Hazardous areas zone 1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 4.2.3 apply.

6.2.4 Hazardous areas zone 2 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 4.2.4 apply.

6.2.5 Ventilation ducts *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 4.2.5 apply.

6.3 Risk assessment

6.3.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 4.3 apply.

6.3.2 *(1/1/2023)*

Guidance on risk assessment techniques can be found in the RINA "Guide for Risk Analysis".

6.3.3 *(1/1/2023)*

The assumptions for the risk assessment are to be agreed by a team of experts acceptable to the Society. It may include a representative of Class, Flag Administration, owner, builder or designer, and consultants having the necessary knowledge and experience in safety, design and/or operation as necessary for the specific evaluation at hand. Other members may include marine surveyors, ship operators, safety engineers, equipment manufacturers, human factors experts, naval architects and marine engineers, according to the problem under scope.

6.3.4 *(1/1/2023)*

The risk assessment can be qualitative or quantitative and is to cover the following aspects:

- Accidental release and dispersion (hydrogen leakages due to tank and piping rupture and permeability, hydrogen dilution in enclosed space, hydrogen effects on material e.g. embrittlement or permeation)
- Ignition (spontaneous ignition of hydrogen during sudden release, minimum energy for ignition)
- Deflagration and detonation (hydrogen explosion hazards)
- Fires (jet fire, radiative heat fluxes, fire resistance of hydrogen system)
- Impact on people, asset and environment (severity of hydrogen incidents)
- Mitigation techniques (detection method, barriers, ventilation level)
- Emergency operation (strategy control of incident)
- Oxygen enrichment due to cryogenic hydrogen temperature.

6.3.5 *(1/1/2023)*

The risk assessment is to follow the steps outlined below.

a) The team of experts is to conduct a Hazard Identification (HAZID) to agree on the scenarios to be subjected to the risk assessment, and on the assumptions regarding the most critical events (typically, connection failures causing an hydrogen or primary fuel release) considering also available internationally recognized standard (e.g. ISO/TR 15916) for the identification of hazards and risks.

b) Reasonable assumptions on the extent of connection failures or other selected events and the process parameters of the hydrogen and primary fuel are to be made by the team of experts, preferably on the basis of statistics available in the public domain or provided and documented by stakeholders.

c) Reasonable assumptions on the operation of ventilation system are to be made according to layout and procedures of the affected space.

d) In order to verify that the hydrogen and primary fuel release will not create flammable concentrations and to demonstrate the drip tray capacity for a liquid leakage, a specific simulation is to be set up, aimed at evaluating the maximum amount of hydrogen spilled and its cloud, the evaporation rate and the possibility to fully accommodate the liquid leakage in the drip tray. The dispersion of vapors resulting from hydrogen

evaporation in the affected space is also to be ascertained in respect of explosive atmosphere.

e) The simulation is to be conducted by commercially available and validated tools (typically, by CFD tools). It is to focus on the calculation of the amount of hydrogen or primary fuel spilled before the stop of hydrogen and primary fuel flow. Other calculation methods (e.g. empirical formulas based on literature) will be subject to special consideration.

f) Reasonable assumptions are to be made by the expert team regarding detection time, hydrogen and primary fuel flow stop time and human reaction time, in case operators are credited in the emergency.

g) If the simulation demonstrates that the drip tray cannot accommodate the liquid spill, mitigating measures are to be provided and subjected to the same simulation process, to appreciate the risk reduction.

7 Control, monitoring and safety systems

MSC.1/Circ.1647 REFERENCE: para. 5

7.1 General provisions on control, monitoring and safety systems

7.1.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 5.1 apply.

7.1.2 *(1/1/2023)*

The fuel cell power installation is to be provided with a safety system with the following characteristics:

- "fail safe" design, so that any failure of the safety system cannot result in an unsafe status for the fuel cell module
- independent from control and alarm system
- compliant with the requirements in Ch 3, Sec 2, [7].

7.2 Gas or vapour detection

7.2.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 5.2 apply.

7.3 Ventilation performance

7.3.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 5.3 apply.

7.4 Bilge wells

7.4.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 5.4 apply.

7.5 Manual emergency shutdown

7.5.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 5.5 apply.

7.6 Actions of the alarm system and safety system

7.6.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 5.6 apply.

7.7 Alarms

7.7.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 5.7 apply.

7.8 Safety actions

7.8.1 *(1/1/2023)*

The requirements in MSC.1/Circ.1647 para. 5.8 apply.

8 Tests on board

8.1 Functioning Tests

8.1.1 *(1/1/2023)*

Where the fuel cell power installation provides power to the electric propulsion system, it is to be verified that the ship has adequate management system of propulsion power in all sailing conditions including maneuvering, according to Ch 1, Sec 16, [3.7].

8.1.2 *(1/1/2023)*

The fuel cell space ventilation system is to be tested prior to the commencement of the sea trials with the verification of the following items:

- air flow of all fans according to the required capacity as per hazardous zone categorization
- alarms and/or automatic shutdown in case of loss or reduction of required ventilation rate
- gas tightness of all flexible connections of fans to duct
- local and remote functioning test of dampers.

8.1.3 *(1/1/2023)*

The fuel cell space inerting system is to be tested prior the commencement of the sea trials with the verification of the following items:

- functioning of inert gas generator or inert gas storage means (e.g. bottles)
- purging of fuel cell space piping conveying hydrogen and primary fuel.

8.1.4 *(1/1/2023)*

The fuel cell space gas detection system is to be tested according to international recognized standard prior the commencement of the sea trials.

8.1.5 *(1/1/2023)*

The following fuel cell power system items are to be tested:

- all automatic safety shutdowns
- emergency safety shutdown (manual ESD) at maximum power load
- protective devices (e.g. safety and automatic shut-off valves)
- measurements systems (e.g. level indicators, temperature measurement devices, pressure gauges).

8.1.6 *(1/1/2023)*

The performance test for the fuel cell power system is to be carried out considering the service profile and is to demonstrate that the fuel cell generated power will meet the performance requirements to be previously agreed with RINA. During all testing the ambient conditions (air temperature, air pressure and humidity) are to be recorded. Moreover, as a minimum, the following fuel cell power

module data are to be measured, recorded and compared with the targeted values:

- Nominal Load Point [A]
- Total Voltage [V]
- Total Current [A]
- Total Power [kW]
- Primary Fuel Consumption [kg/h]
- Fuel Inlet Pressure [bar]
- Fuel Inlet Temperature [C°]
- Cooling Water Inlet Temperature [C°]
- Cooling Water Outlet Temperature [C°]
- Ventilation air flow
- Process air flow

The typical polarization curve (cell voltage vs current) of the fuel cell power system, as created during factory acceptance test, is to be made available on board for prompt reference.

8.1.7 *(1/1/2023)*

The performance tests are to be carried out considering the following conditions:

- start up, ramp up, rump down and automatic shutdown of the fuel cell power system
- load variations and load shedding as per service profile
- interactions with other sources of power, including change-over with the emergency power source.

8.2 Hot spot verification

8.2.1 *(1/1/2023)*

Thermal imaging scanning of equipment where hot surfaces may be expected is to be carried out within the fuel cell power installation under steady and normal operating conditions, according to Ch 1, Sec 2, [6.10.9]. The requirements in Ch 1, Sec 1, [3.7.1] apply.

9 Material Test, Workshop inspections and testing

9.1 General principles

9.1.1 *(1/1/2023)*

The provisions in this section are to be used in conjunction with the applicable requirements on materials and testing in other parts of these Rules and RINA "Rules for Testing and Certification of Marine Materials and Equipment".

9.1.2 *(1/1/2023)*

Inspection and testing of fuel piping systems are to comply with Ch 1, Sec 10, [21].

9.1.3 *(1/1/2023)*

All pressure vessels and piping conveying the primary fuel and the reformed fuel belong to Class I piping systems according to Ch 1, Sec 3 and Sec 10.

Outer pipes of double wall fuel piping arrangements are to be considered to belong to Class II piping systems.

9.1.4 *(1/1/2023)*

The venting and ventilation lines conveying the exhaust air from fuel cell stack cathode side and the exhaust gas from reforming equipment or from fuel cell stack anode side are to be connected with butt welded joints as far as practicable. Alternatively, the use of type approved mechanical joints or other type of connections may be evaluated on case-by-case basis. These lines, if categorized as hazardous, are to be considered to belong to Class I piping systems.

9.2 Type approval

9.2.1 *(1/1/2023)*

Fuel cell modules are to be provided with type approval certificate according to RINA "Rules for the Type Approval of Fuel Cell Power modules".

9.2.2 *(1/1/2023)*

The piping components such as flexible hoses, mechanical joints and plastic pipes are to be provided with type approval certificates according to Ch 1, Sec 10.

9.2.3 *(1/1/2023)*

The electronic and electrical components (e.g. sensors, cables, panels) are to be provided with type approval certificates according to Ch 2, Sec 15, [2].

9.3 Production testing

9.3.1 *(1/1/2023)*

The fuel cell power system is subject to functioning test at workshop under RINA surveyor´s attendance on the basis of previously agreed test program taking into consideration the service profile and the availability of the type approval certificates for the fuel cell modules.

9.3.2 *(1/1/2023)*

Pressure vessels belonging to the fuel cell power system are subject to testing according to Ch 1, Sec 3, [7].

9.3.3 *(1/1/2023)*

The electrical installations for the fuel cell power conditioning are subject to testing according to Ch 2, Sec 15.

9.3.4 *(1/1/2023)*

The automation system components are subject to testing according to Ch 3, Sec 6.

SECTION 2 TESTING PROCEDURES FOR MATERIALS

1 General

1.1 Application

1.1.1 This Section specifies the requirements for testing procedures, testing machines and test specimens for mechanical and technological tests of materials.

The testing procedures and test specimens relevant to welding are specified in Chapter 5.

The Articles of the Rules, dealing with the various products, indicate the examinations and tests required together with the results to be obtained.

The general conditions specified in Sec 1 also apply.

1.2 Testing machines

1.2.1 *(1/1/2023)*

Testing machines are to be maintained in a satisfactory and accurate condition and calibrated by the Society, or by a recognised body in accordance with a recognised standard, at approximately annual intervals.

In particular:

- The accuracy of tensile test machines is to be within ± 1% and when the calibration is in accordance with ISO 7500-1:2018 the permitted indication errors are to be within the specific values for Class 1.
- Impact testing machines are to be calibrated in accordance with ISO 148-2:2016 or other recognised standard.

The striking energy of the testing machine is to be not less than 150 J.

The records of the calibration are to be made available to the Surveyor and kept in the test laboratory.

1.3 Preparation of test specimens

1.3.1 The samples for test specimens are to be in the same condition as the product from which they have been taken and therefore in the same heat treatment condition, if any.

1.3.2 If the test samples are cut from products by flame cut, when admissible depending on the kind of material, or shearing, a reasonable margin is required to enable sufficient material to be removed from cut or sheared edges during final machining.

Test specimens are to be obtained from samples by mechanical cuts; care should be taken in their preparation to avoid any significant straining or heating which might alter the properties of the material.

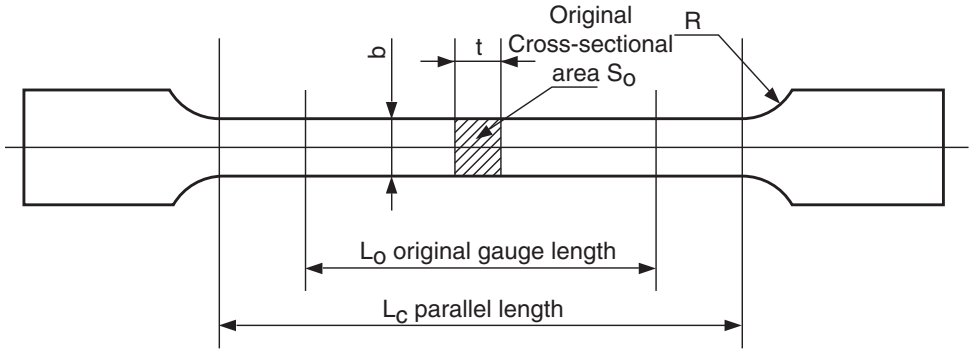
2 Tensile test

2.1 Test specimens

2.1.1 Proportional flat specimen *(1/7/2004)*

For flat products, rectangular specimens of proportional type are generally used, having dimensions as shown in Fig 1.

Figure 1 : Proportional flat specimen *(1/7/2004)*

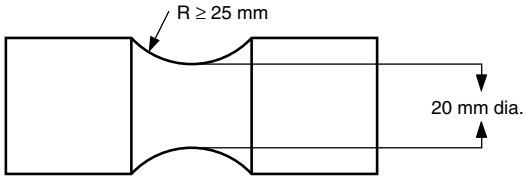


t : thickness of the considered material
b : 25 mm (width)
L_o : $5{,}65S_0^{1/2}$ where S_o is the specimen original cross sectional area. The gauge length may be rounded off the nearest 5 mm provided that the difference between the computed L_o and that rounded length is less than 10% of L_o
L_c : $L_o + 2S_0^{1/2}$
R : 25 mm (transition radius)

2.1.6 Specimen for grey cast iron

For grey cast iron, the test specimen as shown in Fig 4 is to be used.

Figure 4 : Specimen for grey cast iron



2.1.7 Specimens for pipes and tubes *(1/10/2019)*

For testing of pipes and tubes, the testing specimen may be a full cross-section of suitable length to be secured in the testing machine with plugged ends, as shown in Fig 5.

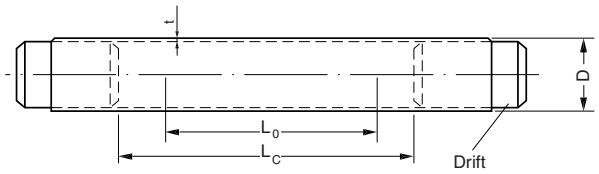
The gauge length L_0 is to be equal to:

$$L_o = 5{,}65\sqrt{S_o}$$

and the distance between the grips or between the plugs L_c is to be not less than the gauge length plus D/2, where D is the external diameter of the tube or pipe.

The length of the plugs projecting over the grips, in the direction of the gauge marks, is not to exceed the external diameter D, and the shape of the plugs is not to impede the elongation of the gauge length.

Figure 5 : Full cross section specimen



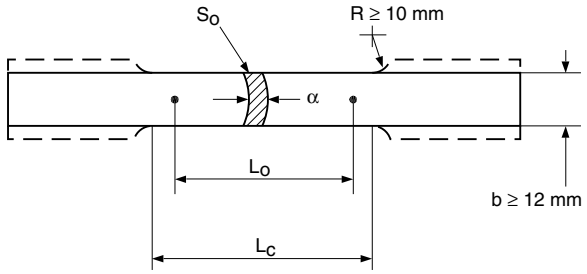
Alternatively test specimens are to be taken from the tube or pipe wall, as shown in Fig 6, where:

$$L_o = 5{,}65\sqrt{S_o}$$

$$L_C = L_0 + 2\,b$$

The parallel test length is not to be flattened, but the enlarged ends may be flattened for gripping in the testing machine.

Figure 6 : Specimen taken from the tube or pipe wall



Where the wall thickness is sufficient to allow machining, the round specimen indicated in Fig 3 may be used, with the axis located at the mid-wall thickness.

2.1.8 Specimen for wires

For testing of wires, a full cross-section test specimen of suitable length is to be used.

The gauge length is to be 200 mm and the parallel test length (distance between the grips) is to be 250 mm.

2.1.9 Specimen for welding *(1/10/2019)*

For testing of welding, unless different requirements are given in Chapter 5, the specimens are to be prepared with the following dimensions.

a) Deposited metal tensile test

Round specimen with the following dimensions is to be used:

d = 10 mm

Lo = 50 mm

Lc > 55 mm

R >= 10 mm

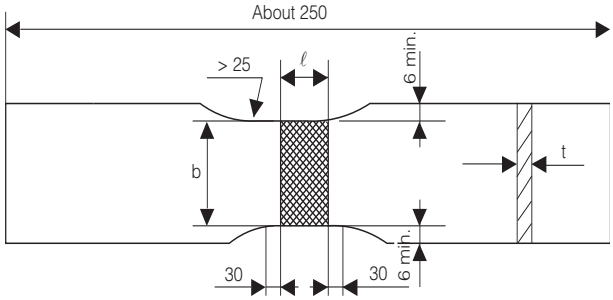
For specially small or large dimensions other specimens may be used after agreement with the Society, provided they conform with the geometrical relationship given in Fig 3 for round proportional specimen.

b) Butt weld tensile test

Flat specimen with the dimensions according to Fig 7 is to be used.

The upper and lower surfaces of the weld are to be filed, ground or machined flush with the surface of the plate.

Figure 7 : Flat tensile test specimen *(1/10/2019)*



b = 12 mm for t ≤ 2 mm
b = 25 mm for t > 2 mm
ℓ = width of weld

2.1.10 Dimensional tolerances *(1/1/2023)*

The dimensional tolerances of test specimens are to be in accordance with ISO 6892-~~98~~1:2019, ISO 6892-2:2018 or other recognised standards as appropriate.

2.2 Testing procedure

2.2.1 General *(1/7/2004)*

The following characteristics, as required by the different products, are to be determined by the test:

a) R_{eH} : Yield stress (yield point), in N/mm^2

b) $R_{p0,2}$ - $R_{p1,0}$: Proof stress (yield strength), in N/mm^2

c) R_m : Tensile strength, in N/mm^2

d) A: Percentage elongation at fracture

e) Z: Percentage reduction of area.

2.2.2 Yield and proof stress determination *(1/7/2004)*

For materials with well defined yield phenomenon, the yield stress R_{eH} is the value corresponding to the first stop or drop of the index, showing the load applied by the testing machine in the tensile tests at ambient temperature.

This applies, unless otherwise specified, to products of carbon steels, carbon-manganese steels and alloy steels, except austenitic and duplex stainless steels.

For materials which do not present a manifest yield stress, as defined above, the 0,2% proof stress ($R_{p0,2}$) is to be determined according to the applicable specification, where 0,2 is the percentage of permanent deformation.

For austenitic and duplex stainless steel products and relevant welding consumables, the 1,0 per cent proof stress, designated by the symbol $R_{p1,0}$, may be required in addition.

2.2.3 Load application rate

The test is to be carried out with an elastic stress within the limits indicated in Tab 1.

After reaching the yield or proof load, for ductile material the machine speed during the tensile test is not to exceed that corresponding to a strain rate of 0,008s^{-1}. For brittle materials, such as cast iron, the elastic stress rate is not to exceed 10 N/mm^2 per second.

Table 1 *(1/7/2004)*

Modulus of Elasticity of the material (E), in N/mm^2	Rate of stressing, in N/mm^2 s^{-1}	
	Min.	Max.
E < 150000	2	20
E ≥ 150000	6	60

2.2.4 Elongation *(1/1/2023)*

The per cent elongation is in general determined on a proportional gauge length L_o.

L_o is determined by the following formula:

$$L_o = 5{,}65\sqrt{S_o}$$

where:

S_o : Original cross-sectional area of the test specimen.

In the case of round solid specimens, L_0 is 5 diameters.

The per cent elongation is also defined as short proportional elongation or A_5.

When a gauge length other than Lo is used, the equivalent per cent elongation A_x required is obtained from the following formula:

A_x : $$2A_5\left(\frac{\sqrt{S}}{L}\right)^{0,4}$$

where:

A_5 : Minimum elongation, in per cent, required by the Rules for the proportional specimens illustrated in Fig 1, Fig 3 and Fig 6

S : Area, in mm^2, of the original cross-section of the actual test specimen

L : Length, in mm, of the corresponding gauge length actually used.

The above conversion formula may be used only for non-cold formed ferritic products with tensile strength not exceeding 700 N/mm^2.

The extension of the formula to other applications, such as cold worked steels, austenitic steels or non-ferrous materials is to be agreed upon with the Society's Surveyors.

In the case of disagreement, the value of elongation computed on the proportional specimen is to be taken.

The gauge length to which the elongation is referred is to be indicated in the test reports.

For non-proportional test specimens with gauge length of 50 mm and 200 mm, the equivalent elongation values indicated in ISO 2566-1:1984; ISO 2566-2:1984 apply.

The elongation value is, in principle, valid only if the distance between the fracture and the nearest gauge mark is not less than one third of the original gauge length. However, the result is valid irrespective of the location of the fracture if the percentage elongation after fracture is equal to or greater than the expected value.

The appearance of the fracture of test specimens after the tensile test is always to be examined. The appearance of the fracture section is to be sound and free from defects and irregularities.

2.2.5 Testing at elevated temperature

For testing at elevated temperature, the determination of 0,2 per cent proof stress is to have a gauge length for strain measurement not less than 50 mm and a cross- sectional area not less than 65 mm^2. However, if the dimensions of the product or the available test equipment do not allow such conditions, the largest possible dimension is to be used.

As yield stress the conventional value of 0,2 per cent proof stress is generally taken; the deformation rate immediately prior to reaching the yield stress is to be in the range between 0,1 and 0,3 per cent of the gauge length per minute.

The intervals between deformation measurements to assess the above-mentioned rate are not to exceed 6 seconds.

The equipment is to permit a test temperature control within a tolerance range ±5°C.

2.2.6 Re-test procedure *(1/7/2004)*

When the tensile test fails to meet the requirements, two further tests may be made from the same piece.

If both of these additional tests are satisfactory, the item and/or batch (as applicable) is acceptable. If either or both of these tests fail, the item and/or batch is to be rejected.

The additional tests detailed above are preferably to be taken from material adjacent to that for the original tests, but alternatively from another test position or sample representative of the item/batch.

Figure 9 : Charpy V-notch specimen

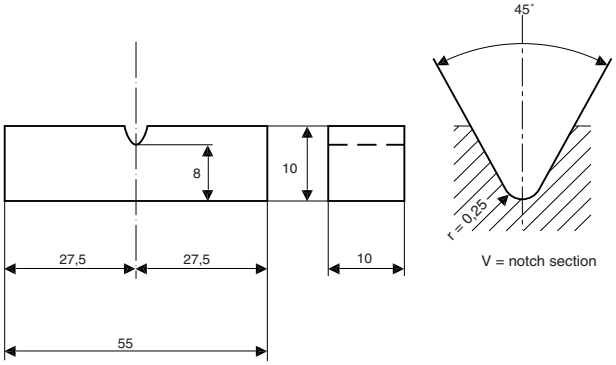


Table 2 : Charpy V-notch specimen

Dimensions	Nominal	Tolerance
Length	55 mm	± 0,60 mm
Width		
• standard specimen	10 mm	± 0,11 mm
• subsize specimen	7,5 mm	± 0,11 mm
• subsize specimen	5,0 mm	± 0,06 mm
Thickness	10 mm	± 0,06 mm
Depth below notch	8 mm	± 0,06 mm
Angle of notch	45 °	± 2°
Root radius	0,25 mm	± 0,025 mm
Distance of notch from end of test specimen	27,5 mm	± 0,42 mm
Angle between plane of symmetry of notch and longitudinal axis of test specimen	90°	± 2°

4.2.2 *(1/7/2004)*

Specimens with reduced sectional area 10x7,5 or 10x5 may be used when the product thickness does not permit machining of the standard size.

All other dimensions and tolerance are to be as specified in [4.2.1].

In all cases the largest size Charpy specimen possible for the material thickness is to be machined.

The required energy values are given in Tab 3.

4.3 Testing procedure

4.3.1 *(1/7/2004)*

Tests on V-notch type specimens are to be carried out at or below ambient temperature, in compliance with the requirements of the parts of the Rules relevant to the individual products and uses.

The term "ambient temperature" means any temperature within the range 18 to 28°C.

Where the test temperature is lower than ambient, the temperature of the specimen at the moment of the breaking is to be the specified test temperature, within plus minus 2°C.

The test temperature is to be clearly specified in the testing documents.

Table 3 : Average energy value for reduced specimens *(1/7/2004)*

Sectional area of V-notch specimens (mm^2)	Minimum average energy **(1)**
10 x 10	KV
10 x 7,5	5/6 KV
10 x 5	2/3 KV
(1) KV is the required average value on standard size specimens, as per the Rules. Only one individual value may be below the specified average value, provided it is not less than 70% of such value.	

4.3.2 For impact tests carried out on a set of three specimens, the Charpy impact toughness is the average adsorbed energy, expressed in Joule (J), resulting from the set.

The average of the results on the three specimens is to comply with the value required for the product in question, and one individual test result may be less than the required average value, provided that it is not less than 70% of it.

4.4 Re-test procedure

4.4.1 *(1/7/2004)*

Where specified the following Charpy re-test procedure will apply.

When the average value of the three initial Charpy V-notch impact specimens fails to meet the stated requirement, or the value for more than one specimen is below the required average value, or when the value of any one specimen is below 70% of the specified average value, three additional specimens from the same material may be tested and the results added to those previously obtained to form a new average. If this new average complies with the requirements and if not more than two individual results are lower than the required average and of these, not more than one result is below 70% of the specified average value, the piece or batch (as specified for each product) may be accepted.

5 Drop weight test

5.1 Definition and specimens dimensions

5.1.1 *(1/1/2023)*

The drop weight according to ASTM Standard E-208:2019 is used for determination of the NDT (nil ductility transition) temperature.

The NDT is the maximum temperature where the drop weight specimen breaks when tested according to the provisions of the standard.

Drop weight specimens have one of the following dimensions (thickness by width by length, in mm[3]):

a) type P1: 25 x 90 x 360

b) type P2: 19 x 50 x 130

c) type P3: 16 x 50 x 130.

5.1.2 The following apply, if not otherwise agreed:

a) the specimen sides are to be saw-cut or machined (minimum 25 mm distance to flame-cut surface)

b) the machining of the sample to obtain the required thickness of the specimen is to be carried out only on one surface; the opposite mill scales surface is to be maintained

c) the direction of the specimen in relation to the rolling direction is not importanct, but all the specimens of the same test series are to have the same orientation.

5.2 Testing procedure

5.2.1 Two test specimens are to be tested at the specified test temperature.

The compression side is to be on the machined side.

Both test specimens are to exhibit no-break performance at the specified temperature.

6 CTOD test (crack tip opening displacement test)

6.1

6.1.1 Unless otherwise agreed, the test is to be performed on specimens of full section thickness according to national or international standards.

Note 1: Internationally accepted standards include BS 7448 Part 1:1991 and ASTM E 1290 1989.

6.1.2 Other fracture mechanics tests intended to check the resistance to brittle fracture of the material may be carried out as required by the Society.

7 Ductility tests for pipes and tubes

7.1 Flattening test

7.1.1 *(1/1/2023)*

The specimen consists of a ring cut with the ends perpendicular to the axis of the pipe or tube.

The length of the specimen is to be from 10 mm to 100 mm.

Plain and smoothed ends cut perpendicular to the tube axis.

Reference is made to ISO 8492:2013.

7.1.2 The test consists of compressing the specimen between two rigid and parallel flat plates in a direction perpendicular to its longitudinal axis; the plates are to cover the whole specimen after flattening.

It is to be continued until the distance Z between the two plates, measured under load, reaches the value specified.

In the case of welded pipes or tubes, the test is to be carried out with the welded seam positioned at 90° and at 0° to the flattening force.

After flattening, the specimen is not to present any cracks or other flaws; however, small cracks at the ends may be disregarded.

7.2 Drift expanding test

7.2.1 *(1/1/2023)*

The specimen consists of a tube section having the ends perpendicular to the tube axis; the edges of the end to be tested may be rounded by filing.

Reference is made to ISO 8493:1998.

7.2.2 *(1/7/2004)*

For metallic tubes the length L of the specimen is to be equal to twice the external diameter D of the tube, if the angle of the drift β is 30°, or equal to 1,5 D if the angle of the drift is 45° or 60°.

The test piece may be shorter provided that after testing the remaining cylindrical portion is not less than 0,5 D.

7.2.3 *(1/7/2004)*

The test consists of flaring the end of the specimen at ambient temperature and symmetrically, by means of a truncated-cone shaped mandrel of hardened steel having the included angle specified in [7.2.2] (Fig 10).

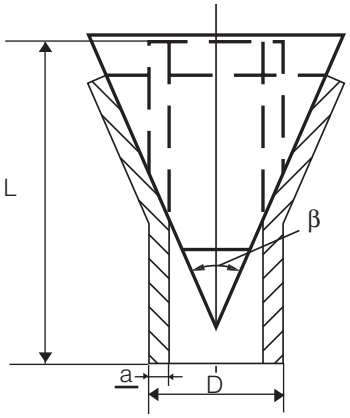
The mandrel is to be lubricated but is not to be rotated in the pipe during the test.

The mandrel penetration is to continue until the increase in external diameter of the end of the expanded zone reaches the value specified in the requirements relevant to the various products.

The rate of penetration of the mandrel is not to exceed 50 mm/min.

The expanded zone of the specimen is not to present any cracks or other flaws.

Figure 10 : Drift expanding test *(1/7/2004)*



7.3 Flanging test

7.3.1 *(1/1/2023)*

The specimen consists of a tube section cut with the ends perpendicular to the tube axis and length at least equal to

approximately 1,5 times the external diameter D of the tube.

The test piece may be shorter provided that after testing the remaining cylindrical portion is not less then 0,5 D.

The edges of the end to be tested may be rounded by filing.

Reference is made to ISO 8494:2013.

7.3.2 *(1/7/2004)*

The test is carried out in two stages and consists of symmetrically forming a flange at one end of the specimen by means of a special mandrel of hardened steel; the mandrel is to be lubricated but is not to be rotated in the tube during the test.

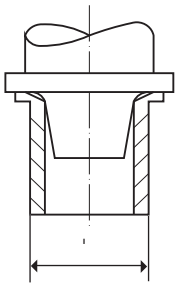
During the first stage of flanging, the end of the specimen is expanded by means of a truncated-cone shaped mandrel having an included angle of 90°; the test is then continued during the second stage using a special forming mandrel to complete the flange.

The test is to be continued until the expanded zone forms a flange perpendicular to the longitudinal axis of the specimen, with an increase in the external diameter of the end of the specimen not less than the value specified (Fig 11).

The rate of penetration of the forming tool is not to exceed 50mm/min.

The cylindrical and flanged portion of the specimen is not to present any cracks or other flaws.

Figure 11 : Flanging test *(1/7/2004)*



7.4 Ring expanding test

7.4.1 *(1/1/2023)*

The specimen consists of a tube section cut with the ends perpendicular to the tube axis and the length between 10 and 16mm.

Reference is made to ISO 8495:2013.

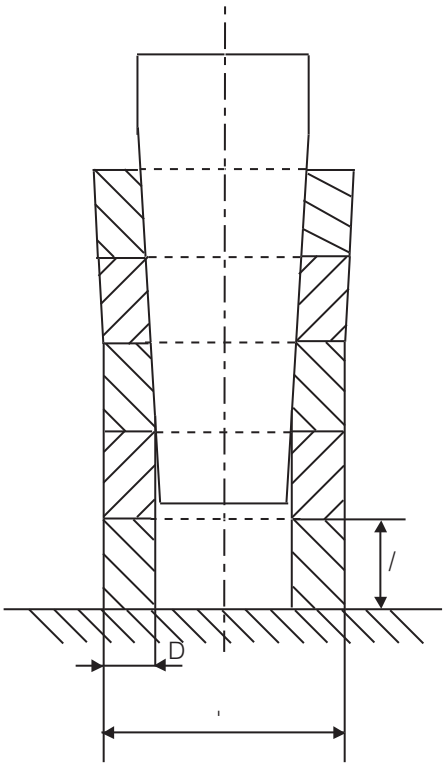
7.4.2 *(1/7/2004)*

The specimen is to be expanded to the prescribed diameter or until fracture occurs (Fig 12).

The rate of penetration of the mandrel is not to exceed 30mm/s.

The expanded specimen is not to reveal unacceptable defects such as cracks, grooves or laminations and is to reach the prescribed expansion.

Figure 12 : Ring expanding test *(1/7/2004)*



7.5 Ring tensile test

7.5.1 *(1/1/2023)*

The specimen consists of a tube section with plain and smoothed ends cut perpendicular to the tube axis and with a length of about 15 mm.

Reference is made to ISO 8496:2013.

7.5.2 *(1/7/2004)*

The specimen is to be drawn to fracture in a tensile testing machine by means of two mandrels having diameter equal to at least three times the wall thickness of the pipe.

The rate is not to exceed 5mm/s.

In the case of welded pipes the weld seam is to be at 90° to the direction of the tensile load.

The specimen after fracture is not to reveal unacceptable defects such as cracks, groves or laminations and is to show visible deformation at the point of fracture.

7.6 Bend test on pipes and tubes

7.6.1 Where feasible, the test specimen consists of full thickness strips not less than 40 mm in width (which may be machined down to 20 mm width for large thickness pipes) cut perpendicular to the pipe axis.

The edges of the specimen may be rounded to 1,5 mm radius.

The result is considered satisfactory if, after being bent through the required angle in the direction of the original curvature, the specimen is free from cracks and laminations; however, small cracks on the edges may be disregarded.

SECTION 1 ROLLED STEEL PLATES, SECTIONS AND BARS

1 General

1.1 Application

1.1.1 General *(1/7/2022)*

The requirements of this Section apply to hot rolled plates, strips, sections and bars intended for hull, structural applications, boilers, pressure vessels and parts of machinery.

Article [1] specifies the requirements common to all the above-mentioned steel products, while the appropriate specific requirements are indicated in Articles [2] to [9].

In the case of applications involving the storage and transport of liquefied gases in bulk and the use of gases or other low-flashpoint fuels, the additional requirements in App 6 apply.

1.1.2 Weldability

Steels in accordance with these Rules are weldable subject to the use of suitable welding processes and, where appropriate, to any conditions stated at the time of approval.

1.1.3 Products with through thickness properties

For products intended for welded construction which may be subject to particular stress in the thickness direction, it is suggested, and may be required, that the material satisfies the through thickness properties indicated in Article [9].

For steels specified in Article [9], a further symbol Z is to be added to the steel designation.

1.2 Manufacture

1.2.1 Steel is to be manufactured by the electric furnace, basic oxygen or open hearth processes.

The use of other processes may be specially approved by the Society.

1.2.2 The steel is to be cast in ingot moulds or by a continuous casting process.

Provision is to be made for sufficient discard such as to ensure:

- at both ends of the ingots, the soundness of the material
- at the transitory zones of continuous casting material, a homogeneous chemical composition along the longitudinal axis.

1.3 Approval

1.3.1 *(1/1/2001)*

The manufacturing process is to be approved by the Society for individual steelmakers, grade of steel and products, as specified in the applicable Articles.

The suitability of each grade of steel for forming and welding is to be demonstrated during the initial approval tests at the steelworks. Approval of the steel works is to follow a scheme accepted by the Society.

Provisions for the approval are given in the "Rules for the approval of Manufacturers of materials".

1.4 Quality of materials

1.4.1 All products are to have a workmanlike finish and to be free from surface or internal defects which may impair their proper workability and use.

1.4.2 *(1/7/2011)*

The responsibility for storage and maintenance of the delivered product(s) with acceptable level of surface conditions rests with the shipyard before the products are used in fabrication.

1.5 Visual, dimensional and non-destructive examinations

1.5.1 Visual, dimensional and, as appropriate, non-destructive examinations are to be performed by the Manufacturer on the materials supplied prior to delivery, as required.

The general provisions indicated in Ch 1, Sec 1, [3.6] and specific requirements for the various products as specified in the relevant Articles of this Section apply.

In the case of doubt about defects [1.4.1], suitable methods of non-destructive examinations may be required by the Surveyor.

1.5.2 *(1/7/2011)*

The thickness of the plates and strips is to be measured at locations of a product or products as defined in the Articles relevant to the various products. In any case, the distance of the locations from the transverse or longitudinal edges of the product is to be not less than 10 mm.

Automated method or manual method is applied to the thickness measurements.

The procedure and the records of measurements are to be made available to the Surveyor and copies provided on request.

The tolerances on nominal thickness are indicated in the Articles relevant to the various products.

The tolerances on nominal thickness are not applicable to areas repaired by grinding, which are to be in accordance with a recognised standard.

The responsibility for verification and maintenance of the production within the required tolerances rests with the Manufacturer. The Surveyor may require to witness some measurements.

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1.10 Documentation and certification

1.10.1 Information required *(1/7/2015)*

The testing documentation indicated in Ch 1, Sec 1, [4.2.1] is required and is to contain all the appropriate information, including at least the following particulars:

a) Purchaser's order number and if known the hull number for which the material is intended.

b) Identification of the cast and piece including, where appropriate, the test specimen number.

c) Identification of the steelworks.

d) Identification of the grade of steel.

e) Ladle analysis (for elements specified in Tab 1 and Tab 2), including the content of refining and alloying elements as applicable.

f) For steel with a corrosion resistant steel designation, the weight percentage of each element added or intentionally controlled to improve corrosion resistance.

g) Condition of supply when other than as rolled i.e. normalised, controlled rolled or thermo-mechanically rolled.

h) State if rimming steel has been supplied for grade A sections, up to 12,5 mm thick.

i) Test Results.

When a limit of C_{EQ} is prescribed, the content of alloying elements may be omitted unless otherwise required.

1.10.2 Inspection certificate

Before signing the Society's inspection certificate or endorsing the inspection certificate issued by the Manufacturer (mill sheets), the Surveyor is to be provided by the Manufacturer with a written declaration, stating that the material has been manufactured by a process accepted by the Society, complies with the applicable requirements and has been satisfactorily tested in accordance with the Rules.

The following wording may be acceptable, either printed or stamped on the delivery documents, with the name of the steel Manufacturer and signed by one of his authorised representatives: "We hereby certify that the material has been made by an approved process and has been satisfactorily tested in accordance with the Society's Rules".

1.10.3 Casting and rolling in different works

When the steel is rolled, heat treated, etc., in a workshop other than that where it is originally cast, the Surveyor is to be supplied with the steelmaker's certificate stating the manufacturing process, the type of steel, the identification of the cast and the ladle analysis.

The workshop where the steel was produced is to be approved by the Society.

The Society's Surveyors are to have free access to the workshop of the original Manufacturer, who is fully responsible for complying with all applicable requirements.

2 Normal and higher strength steels for hull and other structural applications

2.1 Application

2.1.1 The requirements of this Article apply to weldable normal and higher strength steel hot rolled plates, wide flats, sections and bars intended for use in hull construction and other structural applications.

2.1.2 *(1/7/2015)*

Provision is made for:

- plates and wide flats of all grades not exceeding 100 mm in thickness
- sections and bars of all grades not exceeding 50 mm in thickness.

2.1.3 For thickness greater than the above, the requirements may be modified, as appropriate, in the individual cases.

2.1.4 *(1/7/2015)*

The requirements of this Section also apply to normal and higher strength Corrosion Resistant steels when such steel is used as the alternative means of corrosion protection for cargo oil tanks as specified in the performance standard MSC.289 (87) of Regulation 3-11, Part A-1, Chapter II-1 of the SOLAS Convention (Corrosion protection of cargo oil tanks of crude oil tankers). Corrosion Resistant steels, as defined within this Section, are steels whose corrosion resistance performance in the bottom or top of the internal cargo oil tank is tested and approved to satisfy the requirements in MSC.289 (87) in addition to other relevant requirements for hull structural steels, structural strength and construction. It is not intended that such steels be used for corrosion resistant applications in other areas of a vessel that are outside of those specified in the performance standard MSC.289 (87) of Regulation 3-11, Part A-1, Chapter II-1 of the SOLAS Convention. These requirements apply to plates, wide flats, sections and bars in all grades up to a maximum thickness of 50 mm.

2.2 Steel grades

2.2.1 The steels are classed, on the basis of a minimum yield strength level R_{eH} (N/mm^2), into normal strength (R_{eH} = 235) and higher strength (32: R_{eH} = 315 - 36: R_{eH} = 355 - 40: R_{eH} = 390).

Normal strength steels are divided into four grades A, B, D and E. For normal strength steels, the letters A, B, D and E mean impact properties at +20, 0, -20 and -40°C, respectively.

Higher strength steels are divided into four grades identified by the letters AH, DH, EH and FH followed by a number related to the yield strength level. For higher strength steels, the letters AH, DH, EH and FH mean impact properties at 0, -20, -40 and -60°C, respectively.

2.2.2 Steels differing in chemical composition, deoxidation practice, conditions of supply and mechanical properties may be accepted, subject to the special approval of the Society. Such steels are to be given a special designation (see [1.9]).

2.3 Manufacture

2.3.1 Approval *(1/7/2003)*

The Manufacturers are to be approved by the Society and the relevant requirements of [1.2] apply.

It is the Manufacturer's responsibility to assure that effective process and production controls in operation are adhered to within the manufacturing specifications. Where control imperfection inducing possible inferior quality of product occurs, the manufacturer is to identify the cause and establish a countermeasure to prevent its recurrence. Also, the complete investigation report is to be submitted to the Surveyor.

For further use, each affected piece is to be tested to the Surveyor's satisfaction.

The frequency of testing for subsequent products offered may be increased at the discretion of the Society to gain confidence in the quality.

2.3.2 Deoxidation process

The method of deoxidation is specified in Tab 1 and Tab 2.

2.3.3 Dimensional tolerances *(1/1/2023)*

a) The tolerances on thickness of a given product are defined as:

- Minus tolerance is the lower limit of the acceptable range below the nominal thickness.
- Plus tolerance is the upper limit of the acceptable range above the nominal thickness.

For plates and wide flats, with widths of 600 mm or greater, with nominal thickness of 5 mm and over, the minus tolerance on nominal thickness is 0,3 mm irrespective of nominal thickness.

b) The thickness tolerances for products below 5 mm are to be in accordance with a national or international standard, e.g. Class B of ISO 7452:2013. However, the minus tolerance shall not exceed 0,3 mm.

c) The tolerances on nominal thickness are not applicable to areas repaired by grinding. For areas repaired by grinding the requirements in [2.3.6] are to be applied, unless stricter requirements as per a recognized standard are considered by the Society or purchaser.

d) The plus tolerances on nominal thickness are to be in accordance with a recognized national or international standard unless required otherwise by the Society or purchaser.

e) Tolerances for length, width, flatness and over thickness may be taken from national or international standards.

f) Class C of ISO 7452:2013 or equivalent according to national or international standards may be applied in lieu of the requirements in a) to d), in which case the requirements stated in g) and h) need not be applied.

Additionally, if Class C of ISO 7452:2013 is applied, it is required that the steel mill demonstrates to the satisfaction of the Society that the number of measurements and measurement distribution is appropriate to establish that the mother plates produced are at or above the specified nominal thickness.

g) The average thickness of products is defined as the arithmetic mean of the measurements made in accordance with the requirements of h).

The average thickness of products is not to be less than the nominal thickness.

h) The measurement locations apply to a product rolled directly from one slab or steel ingot even if the product is to be later cut by the manufacturer. Examples of the original measurements relative to later cut products are shown in Fig 8. It is to be noted that the examples shown are not representative of all possible cutting scenarios.

At least two lines among Line 1, Line 2 or Line 3 as shown in Fig 7 are to be selected for the thickness measurements and at least three points on each selected line as shown in Fig 7 are to be selected for thickness measurement. If more than three points are taken on each line, the number of points is to be equal on each line.

Automated method or manual method is applied to the thickness measurements.

- For automated methods, the measuring points at sides are to be located not less than 10 mm but not greater than 300 mm from the transverse or longitudinal edges of the product.
- For manual methods, the measuring points at sides are to be located not less than 10 mm but not greater than 100 mm from the transverse or longitudinal edges of the product.

i) The procedure and the records of measurements are to be made available to the Surveyor and copies provided on request.

j) For sections and bars, the under thickness tolerance is to be in accordance with the requirements of a recognised international or national standard.

k) The responsibility for verification and maintenance of the production within the required tolerances rests with the manufacturer. The Surveyor may require to witness some measurements.

2.3.4 Surface quality *(1/7/2018)*

The steel is to be free from surface defects prejudicial to the use of the material for the intended application.

The finished material is to have a surface quality in accordance with a recognized standard such as EN 10163 parts 1, 2 and 3, or an equivalent standard accepted by the Society, unless otherwise specified in this section.

The responsibility for meeting the surface finish requirements rests with the manufacturer of the material, who is to take the necessary manufacturing precautions and is to inspect the products prior to delivery. At that stage, however, rolling or heat treatment scale may conceal surface

8.10.2 All the surface defects are to be ground so as to restore the surface continuity. Nevertheless, such repair by grinding is admitted only if the remaining thickness of the cladding is at least equal to its guaranteed nominal thickness.

8.10.3 In cases where, after grinding, the cladding thickness is less than the guaranteed nominal thickness, the repair is carried out by welding. The filler metal is to be of the same grade as the cladding and the repair procedure is to be defined in agreement with the Surveyor and preliminarily approved.

8.10.4 If, after grinding of the defect, the remaining thickness of the cladding is less than half of the guaranteed nominal thickness, it is necessary to replace the cladding by tapering and to rebuild the whole of the cladding by welding. Such delicate repair is to be carried out in agreement with the Surveyor and preliminarily approved.

8.11 Adhesion defects in the cladding and repairs

8.11.1 In the case of adhesion defects detected by an ultrasonic inspection as defined in [8.9], the areas of non-adhesion of the cladding which exceed the limits specified in [8.9.4] are to be removed by cutting off or to be repaired.

9 Steels with specified through thickness properties

9.1 Application

9.1.1 The requirements of this Article apply to steel plates and wide flats having thickness not less than 15mm, where improved through thickness ductility in the direction of thickness is required (see [1.1.3]).

The extension to lower thicnesses and relevant conditions are at the discretion of the Society.

9.2 Steel grades

9.2.1 *(1/7/2003)*

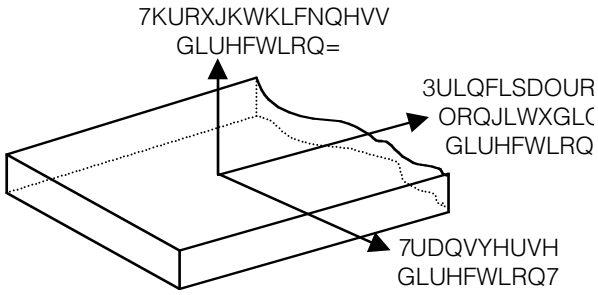
The requirements of Article [9] are intended as a supplement to the requirements of Articles [2], [3], [4], [5], [6] and [7] which specify the quality of steels for hull structures, boilers, pressure vessels, low temperature applications and machinery and are intended to have specified minimum ductility in the through thickness or "Z" direction (see Fig 9).

9.2.2 The Z designation is to be given to any steel grade which has been tested according to the above mentioned specifications, and has been successfully subjected to the tests defined in [9.6] and [9.8].

9.2.3 *(1/7/2003)*

Two "Z" quality steels are specified, Z25 for normal ship applications and Z35 for more severe applications.

Figure 9 : Normal test specimen *(1/7/2003)*



9.3 Manufacture

9.3.1 Approval *(1/7/2003)*

Z grade steel Manufacturers are to be approved by the Society for the specific "Z" quality.

The conditions for approval are indicated in the “Rules for the approval of Manufacturers of materials”.

The procedure has to take into account the improved steelmaking techniques of calcium treatment, vacuum degassing and argon stirring as well as the control of centre-line segregation during continuous casting.

9.4 Chemical composition

9.4.1 *(1/7/2003)*

In addition to the requirements of the appropriate steel specification, the maximum sulphur content is to be 0,008% determined by the ladle analysis.

9.5 Mechanical properties

9.5.1 The ductility in the direction of thickness is evaluated, for the purpose of these requirements with the value of the reduction area measured on tensile test specimens taken in the through thickness direction of the product and prepared as specified in [9.6.4].

9.6 Test Procedure

9.6.1 General *(1/7/2003)*

In addition to the requirements of the appropriate steel specification, preparation of specimens and testing procedures are to be as indicated in the following items [9.6.2] to [9.7.1].

9.6.2 Test sampling *(1/7/2003)*

For plates and wide flats, one test sample is to be taken close to the longitudinal centreline of one end of each rolled piece representing the batch and where applicable preferably at the end corresponding to the top of the ingots. See Tab 29 and Fig 10.

9.6.3 Number of tensile test specimens *(1/7/2003)*

The test sample must be large enough to accommodate the preparation of 6 specimens. 3 test specimens are to be pre-

pared while the rest of the sample remains for possible retest.

9.6.4 Tensile test specimen dimensions *(1/7/2015)*

Round test specimens including the type built-up by welding are to be prepared in accordance with ISO 6892-84, EN 10164-93 or another recognised standard.

Table 29 : Batch size dependent on product and sulphur content *(1/7/2003)*

Product	S > 0,005%	S ≤ 0,005%
Plates	Each piece (parent plate)	Maximum 50t of products of the same cast, thickness and heat treatment
Wide flats of nominal thickness ≤ 25mm	Maximum 10t of products of the same cast, thickness and heat treatment	Maximum 50t of products of the same cast, thickness and heat treatment
Wide flats of nominal thickness > 25mm	Maximum 20t of products of the same cast, thickness and heat treatment	Maximum 50t of products of the same cast, thickness and heat treatment

9.7 Tensile test results

9.7.1 *(1/7/2003)*

The test is considered invalid and a further replacement test is required if the fracture occurs in the weld or heat affected zone.

The minimum average value for the reduction of area of at least 3 tensile test specimens taken in the through thickness direction is to be that shown for the appropriate grade given in Tab 30. Only one individual value may be below the minimum average but not less than the minimum individual value shown for the appropriate grade (see Fig 11).

A value less than the minimum individual value is a cause for rejection.

9.8 Re-test procedure

9.8.1 *(1/7/2003)*

Fig 11 shows the three cases where a re-test situation is permitted. In these instances three more tensile tests are to be taken from the remaining test sample. The average of all 6 tensile tests is to be greater than the required minimum average with no greater than two results below the minimum average.

In the case of failure after re-test, either the batch represented by the piece is rejected or each piece within the batch is required to be tested.

Table 30 : Reduction of area acceptance values *(1/7/2003)*

Grade	Z25	Z35
Minimum average	25%	35%
Minimum individual	15%	25%

9.9 Ultrasonic testing

9.9.1 *(1/1/2023)*

Ultrasonic testing is required and is to be performed in accordance with either EN 10160:1999 Level S1/E1 or ASTM A 578:2017 Level C.

Ultrasonic testing should be carried out on each piece in the final supply condition and with a probe frequency of 4MHz.

9.10 Marking

9.10.1 *(1/7/2003)*

Products complying with these requirements are to be marked in accordance with the appropriate steel requirement and in addition with the notation Z25 or Z35 added to the material grade designation, e.g. EH36Z25 or EH36Z35.

9.11 Certification

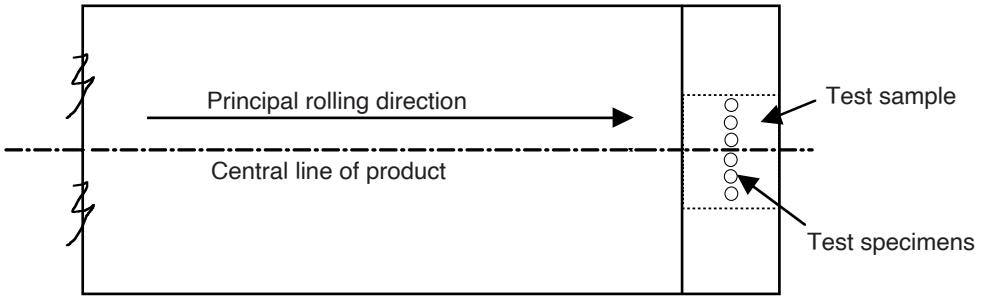
9.11.1 *(1/7/2003)*

The following information is required to be included on the certificate in addition to the appropriate steel requirement:

a) through thickness reduction in area (%)

b) steel grade with Z25 or Z35 notation.

Figure 10 : Plate and wide flat sampling position *(1/7/2003)*



SECTION 2 ALUMINIUM ALLOYS

1 General

1.1 Application

1.1.1 General

The requirements of this Section apply to wrought aluminium alloys, rivets, transition joints and cast aluminium alloys.

1.1.2 Other standards

Alloys and tempers other than those defined in Articles [2], [3], [4] and [5], and which comply with national or international standards or proprietary specifications deemed equivalent to these requirements, may be accepted with the agreement of the Society.

1.1.3 Weldability

Except for rivets, aluminium products in accordance with these Rules are weldable using suitable welding processes and, where appropriate, subject to any conditions stated at the time of approval.

1.2 Manufacture

1.2.1 Manufacturing process

Manufacturing processes and heat treatments suitable to obtain products having the specified quality and properties are, in principle, left to the discretion of the Manufacturer.

Heat treatment is to be carried out in suitable furnaces fitted with the necessary equipment, in accordance with appropriate procedures, to the satisfaction of the Surveyor.

1.2.2 Approval

The manufacturing and treatment processes and the control systems are to be approved by the Society for individual Manufacturers. To this end, detailed information is to be submitted to the Society and, as a rule, checks and tests are required depending on the importance of the product and its intended use.

1.2.3 Quality of material

All products are to have a workmanlike finish and be free from defects, surface or internal imperfections, segregation and non-metallic inclusions which may impair their proper workability and use.

1.2.4 Identification

The Manufacturer is to adopt a system of identification which will ensure that all finished material in a batch presented for testing is of the same nominal chemical composition.

1.2.5 Marking

Products are to be clearly marked by the Manufacturer in accordance with the requirements of Chapter 1.

The following details are to be shown on all materials which have been accepted:

- Manufacturer's mark
- grade of alloy and temper conditions
- number of the manufacturing batch enabling the manufacturing process to be traced
- Classification Society's brand.

When extruded products are bundled together or packed in crates for delivery, the marking is to be affixed by a securely fastened tag or label.

1.2.6 Certification and documentation *(1/1/2013)*

Each test certificate or shipping statement is to include the following particulars:

- purchaser's name and order number
- description and dimensions
- specification or grade of alloy
- details of heat treatment, where applicable
- identification mark which will enable the full history of the item to be traced
- chemical composition
- mechanical test results (not required on shipping statement)
- corrosion test results (if any).

Where the alloy is not produced at the works at which it is wrought, a certificate is to be supplied by the Manufacturer of the alloy stating the cast number and chemical composition. The works at which the alloy was produced is to be approved by the Society.

2 Wrought aluminium alloy products (plates, bars, sections and tubes)

2.1 Application

2.1.1 The requirements of this Article apply to wrought aluminium alloys used in the construction of hulls and other marine structures, and for cryogenic applications.

2.1.2 These requirements are applicable to wrought aluminium products within a thickness range between 3 mm and 50 mm inclusive.

2.1.3 The application of these provisions to aluminium alloy products outside this thickness range requires the prior agreement of the Society.

The general requirements specified in Article [1] are also to be complied with, as appropriate.

2.1.4 In the case of ships carrying liquefied gas in bulk, the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk also applies.

Materials intended for the construction of cargo tanks or storage tanks for liquefied gases and for other low temperature applications are to be manufactured in 5083 alloy in the annealed condition.

2.2 Aluminium grades

2.2.1 Designation *(1/1/2023)*

The numerical designation (grade) of aluminium alloys and their temper designation are in accordance with the "Registration Record of International Alloy Designation".

Temper conditions (delivery heat treatment) are defined in EN 515:2017 or ANSI H35.1:2017.

2.2.2 Rolled products (sheets, strips and plates) *(1/7/2005)*

The following aluminium alloys are covered by these requirements:

- 5083
- 5059
- 5086
- 5383
- 5456
- 5754

with the following temper conditions:

- O, H111, H112
- H116
- H321

2.2.3 Extruded products (sections, shapes, bars and closed profiles) *(1/7/2005)*

The following aluminium alloys are covered by these requirements:

- 5083
- 5059
- 5086
- 5383

with the following temper conditions:

- O, H111, H112

and

- 6005A
- 6061
- 6082

with the following temper conditions:

- T5 or T6

The alloy grades 6005A and 6061 of the 6000 series are not to be used in direct contact with sea water unless protected by anodes and/or a paint system.

2.3 Manufacture

2.3.1 Approval

All materials, including semi-finished products, are to be manufactured at works which are approved by the Society for the grades of aluminium alloy supplied ([1.2.2]).

Plates are to be formed by rolling and may be hot or cold finished.

Bars and sections may be formed by extrusion, rolling or drawing.

2.3.2 Quality of materials

It is the producer's responsibility to check the quality of the materials as well as conformity with dimensional tolerances.

2.3.3 Repairs

Slight surface imperfections may be removed by grinding or machining provided the thickness of the material remains everywhere within acceptable tolerances.

The repair of defects by welding is not accepted.

2.3.4 Dimensional tolerances *(1/7/2005)*

The under thickness tolerances for rolled products given in Tab 1 are minimum requirements.

The underthickness tolerances for extruded products are to be in accordance with the requirements of recognised international or national standards.

Dimensional tolerances other than under thickness tolerances are to comply with a recognised national or international standard.

2.3.5 Non-destructive examination

In general, the non-destructive examination of material is not required for acceptance purposes.

Table 1 : Under thickness tolerances for rolled products

Nominal thickness (mm)	Thickness tolerances for nominal width (mm)		
	up to 1500	from 1500 to 2000	from 2000 to 3500
from 3 to 4	0,10	0,15	0,15
from 4 to 8	0,20	0,20	0,25
from 8 to 12	0,25	0,25	0,25
from 12 to 20	0,35	0,40	0,50
from 20 to 50	0,45	0,50	0,65

2.4 Chemical composition

2.4.1 The Manufacturer is to determine the chemical composition of each cast.

2.4.2 *(1/7/2005)*

The chemical composition of aluminium alloys is to comply with the requirements given in Tab 2.

The Manufacturer's declared analysis is accepted subject to occasional checking if required by the Surveyor; in particular, product analysis may be required where the final product chemistry is not well represented by the analysis from the cast.

2.4.3 When the aluminium alloys are not cast in the same works in which they are manufactured into semi-finished products, the Surveyor is to be given a certificate issued by the works in question indicating the reference numbers and chemical composition of the heats.

2.5 Corrosion testing

2.5.1 *(1/7/2015)*

Rolled 5xxx-alloys of type 5083, 5383, 5059, 5086 and 5456 in the H116 and H321 tempers intended for use in marine hull construction or in marine applications where frequent direct contact with seawater is expected are to be corrosion tested with respect to exfoliation and intergranular corrosion resistance.

2.5.2 *(1/1/2023)*

The Manufacturers are to establish the relationship between microstructure and resistance to corrosion when the alloys as per [2.5.1] are approved. A reference photomicrograph taken at 500x, under the conditions specified in ASTM B928:2015, Section 9.4.1, is to be established for each of the alloy-tempers and thickness ranges relevant. The reference photographs are to be taken from samples which have exhibited no evidence of exfoliation corrosion and a pitting rating of PB or better, when subjected to the test described in ASTM G66:2018 (ASSET). The samples are also to have exhibited resistance to intergranular corrosion at a mass loss no greater than 15mg/cm^2, when subjected to the test described in ASTM G67:2018 (NAMLT). Upon satisfactory establishment of the relationship between microstructure and resistance to corrosion, the master photomicrographs and the results of the corrosion tests are to be approved by the Society. Production practices are not to be changed after approval of the reference micrographs.

Other test methods may also be accepted at the discretion of the Society.

2.5.3 *(1/1/2023)*

For batch acceptance of 5xxx-alloys in the H116 and H321 tempers, metallographic examination of one sample selected from mid width at one end of a coil or random sheet or plate is to be carried out. The microstructure of the sample is to be compared to the reference photomicrograph of acceptable material in the presence of the Surveyor. A longitudinal section perpendicular to the rolled surface is to be prepared for metallographic examination, under the conditions specified in ASTM B928:2015, Section 9.6.1.

If the microstructure shows evidence of continuous grain boundary network of aluminium-magnesium precipitate in excess of the reference photomicrographs of acceptable material, the batch is either to be rejected or tested for exfoliation-corrosion resistance and intergranular corrosion resistance subject to the agreement of the Surveyor. The corrosion tests are to be in accordance with ASTM G66:2018 and G67:2018 or equivalent standards. Acceptance criteria are that the sample shall exhibit no evidence of exfoliation corrosion and a pitting rating of PB or better when test subjected to ASTM G66:2018 ASSET test, and the sample shall exhibit resistance to intergranular corrosion at a mass loss no greater than 15mg/cm^2 when subjected to ASTM G67:2018 NAMLT test.

If the results from testing satisfy the acceptance criteria stated in [2.5.2] the batch is accepted, otherwise, it is to be rejected.

As an alternative to metallographic examination, each batch may be tested for exfoliationcorrosion resistance and intergranular corrosion resistance, in accordance with ASTM G66:2018 and G67:2018 under the conditions specified in ASTM B928:2015, or equivalent standards. If this alternative is used, then the results of the test must satisfy the acceptance criteria stated in this item [2.5.3].

2.5.4 *(1/7/2005)*

Tempers that are corrosion tested are to be marked "M" after the temper condition, e.g. 5083 H321M.

2.6 Mechanical properties

2.6.1 *(1/7/2005)*

Mechanical properties are specified in Tab 3 and Tab 4.

2.7 Mechanical tests

2.7.1 General *(1/7/2005)*

Test specimens for mechanical tests and procedures are to be selected in accordance with Chapter 1 or national or international requirements relative to the wrought aluminium alloy materials concerned.

The Manufacturer is to demonstrate by macro-section tests or drift expansion tests of closed profiles performed on each batch of closed profiles that there is no lack of fusion at the press welds.

Once cut and machined, test materials are not to be submitted to any heat or mechanical treatment.

2.7.2 Batch composition

Each batch is made of products:

a) of the same alloy grade and from the same cast

b) of the same product form and of similar dimensions (for plates: same thickness)

c) manufactured by the same process

d) having been submitted simultaneously to the same temper condition.

SECTION 1 EQUIPMENT

1 Anchors

1.1 Application

1.1.1 General

The requirements of this Article apply to anchors and associated components (heads, shanks and shackles) made of cast or forged steel, or fabricated by welding from rolled steel.

1.1.2 Modified testing procedure for anchors of small mass

For anchors having mass lower than 100 kg, or 75 kg in the case of high holding power anchors, continuously produced by Manufacturers who have been approved by the Society for this purpose, a batch testing procedure is admitted, with random execution of the checks required for normal testing.

The composition of the batches is to be judged appropriate as regards the homogeneity of material, manufacturing, heat treatment and dimensions.

1.2 Design - Manufacture

1.2.1 General *(1/2/2007)*

Anchors are to be manufactured by recognised Manufacturers, according to approved plans or recognised standards; see Pt B, Ch 10, Sec 4, [3.2].

For approval and/or acceptance of high holding power (HHP) and super high holding power (SHHP) anchors , the type tests indicated in Pt B, Ch 10, Sec 4, [3.2] are to be carried out.

Steel forgings and castings for anchors is to comply with the applicable requirements of Ch 2, Sec 3 and Ch 2, Sec 4, respectively, and are to be manufactured by recognised Manufacturers.

1.2.2 Tolerances *(1/1/2007)*

If not otherwise specified on standards or on drawings demonstrated to be appropriate, the following assembly and fitting tolerances are to be applied.

The clearance either side of the shank within the shackle jaws is to be in accordance with Tab 1 depending on the anchor mass.

The shackle pin is to be a push fit in the eyes of the shackle, which are to be chamfered on the outside to ensure a good tightness when the pin is clenched over on fitting.

The shackle pin to hole tolerance is to be no more than 0,5mm for pins up to 57mm and 1,0 mm for pins of larger diameter.

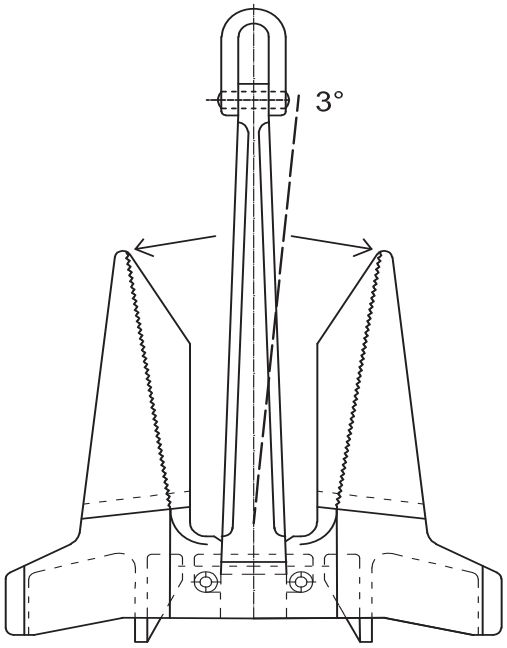
The trunnion pin is to be a snug fit within the chamber and be long enough to prevent horizontal movement. The gap is to be no more than 1% of the chamber length.

The lateral movement of the shank is not to exceed 3 degrees (see Fig 1).

Table 1 *(1/1/2007)*

Anchor mass (t)	Clearance (mm)
Up to 3	3
Over 3 up to 5	4
Over 5 up to 7	6
Over 7	12

Figure 1 *(1/1/2007)*



1.2.3 Welded anchors *(1/1/2007)*

Welded anchors are to be manufactured in accordance with approved procedures.

1.2.4 Heat treatment *(1/1/2007)*

Components for forged or cast anchors are to be properly heat treated in accordance with the applicable requirements of Ch 2, Sec 3 and Ch 2, Sec 4, respectively.

Fabricated anchors may require stress relief after welding depending upon weld thickness.

Stress relief is to be carried out as indicated in the approved welding procedure.

Stress relief temperatures are not to exceed the tempering temperature of the base material.

1.7.2 *(1/1/2007)*

The testing documentation indicated in Ch 1, Sec 1, [4.2.1] is required and is to include as a minimum the following information:

- Manufacturer's name
- Type
- Mass
- Fluke and Shank identification numbers
- Grade of materials
- Proof test loads
- Heat treatment
- Marking applied to anchor.

1.8 Painting

1.8.1 *(1/1/2007)*

No type of anchor is to be painted until all tests and inspections have been completed.

2 Stud link chain cables and accessories

2.1 Application

2.1.1 General

The requirements of this Article apply to the materials, design, manufacture and testing of stud link anchor chain cables and accessories used for ships.

2.2 Chain cable grades

2.2.1 Depending on the nominal tensile strength of the steel used for manufacture and on the type of manufacture, stud link chain cables are to be divided into the following grades:

a) Q1a for flash welding - ordinary steel

b) Q2a for flash welding and drop forging - high tensile steel

c) Q2b for casting - high tensile steel

d) Q3a for flash welding and drop forging - very high tensile steel

e) Q3b for casting - very high tensile steel.

2.3 Approval of chain cable Manufacturers

2.3.1 Anchor chain cables and accessories are to be manufactured by works approved by the Society; approval tests are required.

Applications for approval are to provide detailed information about the production works and fabricated chains such as the method of manufacture, the grade of materials, the links' nominal dimensions, etc.

Where materials with chemical composition or properties other than those given in Tab 3 and Tab 4 are proposed, their acceptance is at the Society's discretion. The same applies in the case of design of links different from [2.9.2].

2.4 Steels for chain cables

2.4.1 General

These requirements apply to rolled steels, forgings and castings used for the manufacture of anchor chain cables and accessories.

2.4.2 Requirements for material Manufacturers *(1/7/2003)*

All materials used for the manufacture of anchor chain cables and accessories are to be supplied by Manufacturers approved by the Society. Approval is not required for Grade Q1 steel bars.

Material suppliers of Grade Q3 chain cable Manufacturers are to submit specifications of the materials used. These specifications are to contain all necessary details, such as manufacturing procedure, deoxydation practice, specified chemical composition, heat treatment and mechanical properties.

2.5 Rolled steel bars

2.5.1 Supply condition

Unless otherwise stipulated (i.e. heat treatment), the steel bars are supplied in the as-rolled condition.

The steel bars are to be supplied with a works' certificate indicating the chemical composition and the delivery condition.

2.5.2 Chemical composition

The chemical composition of steel bars is generally to be within the limits given in Tab 3.

2.5.3 Sampling for mechanical tests *(1/7/2003)*

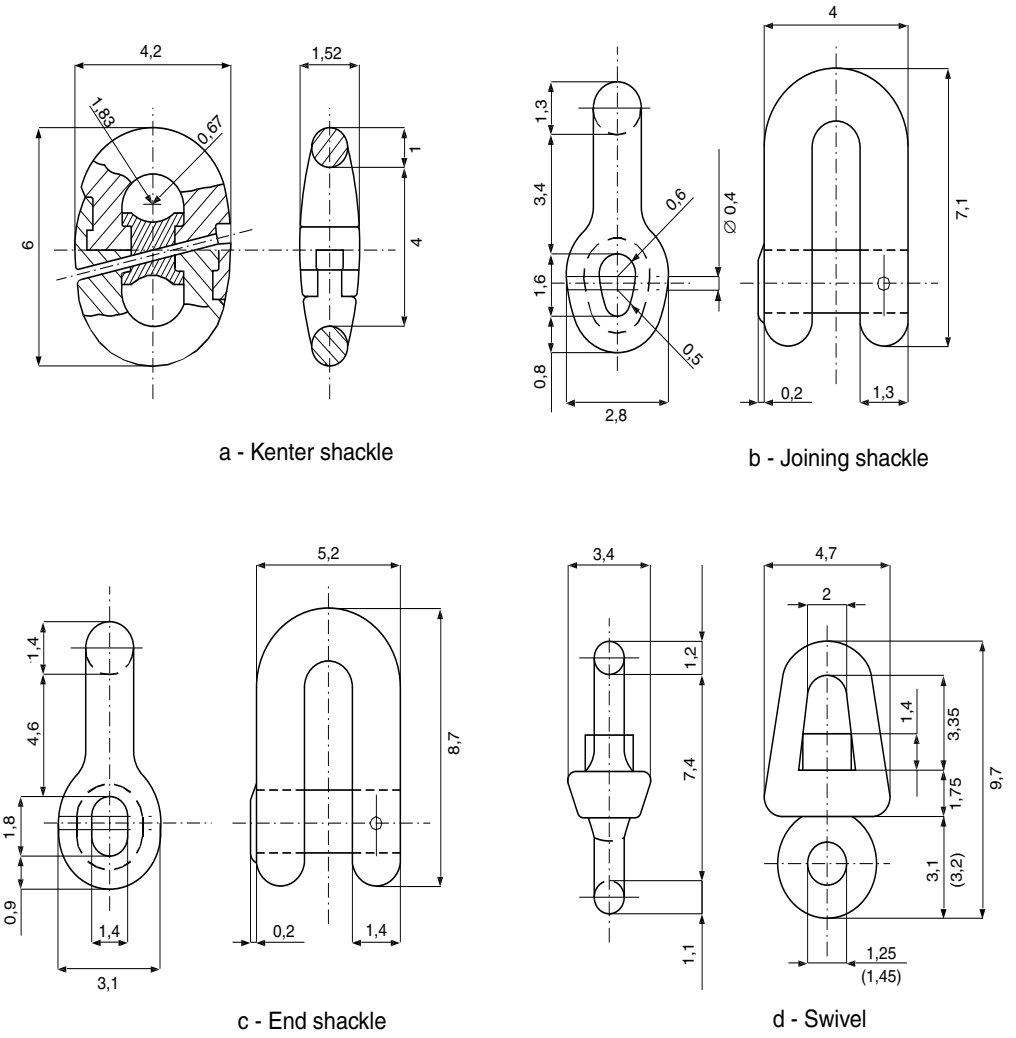
For performance of mechanical tests, steel bars are to be sorted according to heats and diameters into batchs not exceeding 50 t each. A test sample is to be taken from each batch for tensile tests and, when required depending on the grade, for impact tests. Prior to sampling, the test samples are to be subjected to the heat treatment provided for the finished chain cables; see Tab 6. Details of the heat treatment are to be provided by the chain cable Manufacturer.

The tensile and Charpy V-notch impact test specimens are to be taken from the test sample in the longitudinal direction at a distance of 1/6 diameter from the surface or as close as possible to this position (see Fig 3).

For the tensile test, one specimen is to be taken from each batch.

One set of longitudinal Charpy V-notch test specimens shall be taken from each test unit and tested at the temperature prescribed in Tab 4. The specimen transverse axis is to be radial to the steel bar. The average value obtained from one set of three impacts specimens is to comply with the requirements given in Tab 4. One individual value only may be below the specified average value provided it is not less than 70% of that value.

Figure 5 : Typical design of shackles and swivels



All dimensions are shown as multiples of the nominal diameter d of the common link.

For swivels, dimensions in brackets may apply to cast steel swivels.

2.8 Materials for studs

2.8.1 The studs are to be made of steel corresponding to that of the chain cable or from rolled, cast or forged ordinary steel, as indicated in the chain specification; grey or nodular cast iron is not permitted.

2.9 Design and manufacture

2.9.1 Manufacturing process *(1/7/2003)*

Stud link chain cables are preferably to be manufactured by flash welding using grade Q1, Q2 or Q3 steel bars. Manufacture of the links by drop forging or steel casting is permitted.

Accessories such as shackles, swivels and swivel shackles are to be forged or cast in steel of at least Grade 2. The welded construction of these parts may also be approved.

2.9.2 Design *(1/1/2023)*

Chain cables are to be designed according to a standard recognised by the Society, such as ISO 1704:2008. Typical designs are given in Fig 4 and Fig 5. Where designs do not comply with these figures and where accessories are of welded construction, drawings giving full details of the design, the manufacturing process and the heat treatment are to be submitted to the Society for approval.

A length of chain cable is to comprise an odd number of links.

2.9.3 Heat treatment *(1/7/2003)*

According to the grade of steel, chain cables and accessories are to be supplied in one of the conditions specified in Tab 6. The heat treatment is to be performed before the proof load test, the breaking load test, and all mechanical testing.

Table 6 : Condition of supply of chain cables and accessories *(1/7/2003)*

Grade	Chain cables	Accessories
Q1	As-welded or normalised	NA
Q2	As welded or normalised **(1)**	Normalised
Q3	Normalised, Normalised and tempered or quenched and tempered	Normalised, Normalised and tempered or quenched and tempered

(1) Grade Q2 chain cables made by forging or casting are to be supplied in the normalised condition.

NA = Not applicable.

2.9.4 Mechanical properties *(1/7/2003)*

The mechanical properties of finished chain cables and accessories are to be in accordance with Tab 8.

2.9.5 Proof and breaking load properties

Chain cables and accessories are to withstand the proof and breaking loads indicated in Tab 9, depending on the relevant chain cable grade.

2.9.6 Freedom from defects

All individual parts are to have a clean surface consistent with the method of manufacture and be free from cracks, notches, inclusions and other defects impairing the performance of the product. The flashes produced by upsetting or drop forging are to be properly removed.

Minor surface defects may be ground off so as to leave a gentle transition to the surrounding surface. Remote from the crown, local grinding up to 5% of the nominal link diameter may be permitted.

2.9.7 Dimensions and dimensional tolerances *(1/1/2023)*

The shape and proportions of links and accessories are to conform to a recognised standard (see Fig 4 and Fig 5) such as ISO 1704:2008 or the designs specially approved.

The permissible tolerances applicable to links are the following :

a) Diameter measured at the crown (two measurements are to be taken at the same location: one in the plane of the link, see dp in Fig 6, and one perpendicular to the plane of the link:
   - up to 40 mm nominal diameter: -1mm
   - over 40 up to 84 mm nominal diameter: -2 mm
   - over 84 up to 122 mm nominal diameter: -3 mm
   - over 122 mm nominal diameter: -4 mm
   - the plus tolerance may be up to 5% of the nominal diameter.

   The cross-sectional area of the crown is to have no negative tolerance.

b) Diameter measured at locations other than the crown:

   The diameter is to have no negative tolerance. The plus tolerance may be up to 5% of the nominal diameter. The approved Manufacturer's specification is applicable to the plus tolerance of the diameter at the flush-butt weld.

c) The maximum allowable tolerance on assembly measured over a length of 5 links may equal +2,5%, but may not be negative (tolerance measured with the chain under tension after proof load test, which means chain loaded to about 10% of the proof load or stretched to full inter-link contact).

d) All other dimensions are subject to a manufacturing tolerance of ±2,5%, provided always that all parts of the chain cable fit together properly.

e) Studs are to be located in the links centrally and at right angles to the sides of the link, although the studs of the final link at each end of any length may also be located off-centre to facilitate the insertion of the joining shackle.

   The following tolerances are regarded as being inherent in the method of manufacture and are not to be objected to, provided that the stud fits snugly and its ends lie practically flush against the inside of the link.

   Maximum off-centre distance "X": 10% of the nominal diameter d,

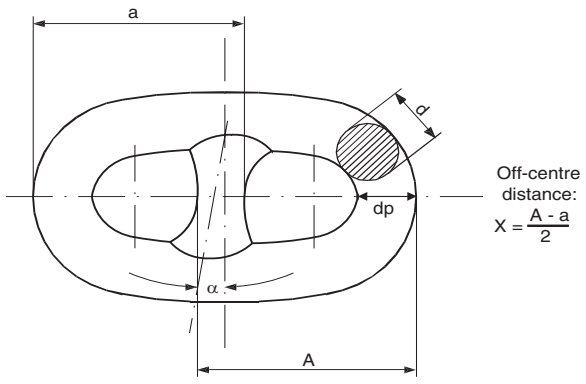
   Maximum deviation "α" from the 90°- position: 4°.

   The tolerances are to be measured in accordance with Fig 6.

The following tolerances are applicable to accessories:

- nominal diameter : +5%, -0%
- other dimensions : ± 2,5%.

Figure 6 : Manufacturing tolerances



2.9.8 Welding of studs *(1/7/2003)*

For all grades of stud link anchor chain cables, it is possible to secure studs on the links by welding.

The welding of chain studs is to be in accordance with an approved procedure subject to the following conditions:

a) the studs are to be of weldable steel (see [2.8])

b) the studs are to be welded at one end only, i.e., opposite to the weldment of the link. The stud ends are to fit the inside of the link without appreciable gap

c) the welds, preferably in the horizontal position, are to be executed by qualified welders using suitable welding consumables

SECTION 2 APPROVAL OF WELDING CONSUMABLES

1 General

1.1 Application

1.1.1 *(1/7/2019)*

The requirements of this Section apply to the approval and inspection of consumables for welding normal and higher strength hull structural steels, high strength steels, chromium and chromium-molybdenum steels, nickel steels for low temperature applications, austenitic and austenitic-ferritic stainless steels, and aluminium alloys.

1.1.2 *(1/7/2019)*

Articles [1] to [7] of this Section provide the requirements for the approval and inspection of welding consumables used for the following hull structural steels:

- normal strength steels Grades A, B, D and E;
- higher strength steels Grades A32, D32, E32, A36, D36 and E36;
- higher strength steels with minimum yield strength 390 N/mm^2: Grades A40, D40 and E40;
- higher strength steels for low temperature application: Grades F32, F36 and F40.

Welding consumables for high strength steels for welded structures are to comply with the requirements of Article [8].

The requirements of articles [1] to [7] may also be applied to the corresponding grades of steel forgings and castings, and of comparable steels intended for other structural applications or pressure systems.

1.1.3 Categories of products *(1/7/2019)*

The concerned welding consumables are divided into several categories as follows:

- covered electrodes for manual and gravity welding;
- wire/flux combinations for two run or multi-run submerged arc welding;
- solid wire/gas combinations for continuous wire arc welding;
- flux cored wires for continuous wire arc welding with or without shielding gas;
- consumables for use in electroslag and electrogas vertical welding.

1.2 Grading

1.2.1 Basic groups and grades *(1/7/2019)*

Filler metals are divided into three groups:

- normal strength filler metals for welding normal strength hull structural steels;
- higher strength filler metals for welding normal and higher strength hull structural steels with minimum yield strength up to 355 N/mm^2;
- higher strength filler metals for welding normal and higher strength hull structural steels with minimum yield strength up to 390 N/mm^2.

Each of the three groups is based on corresponding tensile strength requirements.

Each filler metal group is further divided into several grades:

a) Grades 1, 2 and 3 for ordinary-strength filler metals;

b) Grades 1Y, 2Y, 3Y and 4Y for higher strength filler metals for steels up to 355 N/mm^2 yield strength;

c) Grades 2Y40, 3Y40, 4Y40 and 5Y40 for higher strength filler metals for steels up to 390 N/mm^2 yield strength.

The Grade assignment is given in respect of Charpy V-notch impact test requirements.

For each strength basic group, welding consumables, which have satisfied the requirements for a higher toughness grade are considered as complying with the requirements for a lower toughness grade.

1.2.2 Correlation of welding consumables to hull structural steel grades *(1/7/2019)*

The correlation between the hull steel grades and the welding consumables grades that are to be used for the hull steel welding, is stated in Tab 1.

When joining normal to higher strength structural steel, consumables of the lowest acceptable grade for either material being joined may be used.

When joining steels of the same strength level but of different toughness grade, consumables of the lowest acceptable grade for either material being joined may be used.

It is recommended that controlled low hydrogen type consumables are used when joining higher strength structural steel to the same or lower strength level, except that other consumables are used, at the discretion of the Society, when the carbon equivalent is below or equal to 0.41%. When other than controlled low hydrogen type electrodes are used appropriate procedure tests for hydrogen cracking may be conducted at the discretion of the Society.

1.2.3 Hydrogen marks *(1/7/2019)*

Welding consumables of Grades 2 and 3 and Grades 2Y, 3Y and 4Y and of Grades 2Y40, 3Y40, 4Y40 and 5Y40, for which the hydrogen content has been controlled in accordance with [4.5.3] are identified by the mark H15, H10 or H5.

and the sharp corners of the specimens rounded to a radius not exceeding 2 mm.

d) Charpy V-notch impact test

The test specimens are to be cut with their longitudinal axes transverse to the weld length and:

1) at mid thickness of the weld in the deposit metal and butt weld test assemblies with multi-run technique;

2) on the 2nd run side, 2 mm maximum below the surface in the two-run welded test assemblies;

3) 2 mm maximum below one surface in the electroslag or electrogas welded test assemblies.

The notch is to be cut in the face of the test piece perpendicular to the surface of the plate and is to be positioned in the centre of the weld and, for electroslag and electrogas welded test assemblies, also at 2 mm from the fusion line in the deposited metal.

3.2 Testing procedures

3.2.1 General *(1/7/2019)*

The test specimens for mechanical tests are to be taken from the welded assemblies as indicated in the various Articles.

The requirements relevant to the calibration of the equipment, preparation of test specimens and testing procedure, detailed in Ch 1, Sec 2, are also to be complied with, as appropriate.

3.2.2 Tensile tests *(1/7/2019)*

On deposited metal test specimens, the values of yield stress, tensile strength and elongation are to be recorded.

On butt weld specimens, the values of tensile strength are to be recorded together with the position of fracture.

3.2.3 Bend *(1/7/2019)*

The test specimens are to be capable of withstanding, without fracture or crack, being bent through an angle of 120° over a former having a diameter three times the thickness of the specimen. However, superficial cracks of less than 3 mm long on the outer surface should not be taken into consideration.

For each set of bend tests one specimen is to be tested with the face of the weld in tension and the other with the root of the weld in tension except in the electroslag or electrogas welded test assemblies, where side bend tests are carried out in lieu of face and root bend tests.

3.2.4 Charpy V-notch impact *(1/7/2019)*

A set of three test specimens is to be prepared and tested. The average absorbed energy value is to comply with the requirements of subsequent sections. One individual value may be less than the required average value provided that it is not less than 70% of this value.

The test temperature for Grades 2, 2Y, 2Y40, 3, 3Y, 3Y40, 4Y, 4Y40 and 5Y40 test pieces is to be controlled to within ±2°C of the prescribed temperature.

3.3 Re-test procedures

3.3.1 Tensile and bend *(1/7/2019)*

Where the result of a tensile or bend test does not comply with the requirements, duplicate test specimens of the same type are to be prepared and satisfactorily tested. Where insufficient original welded assembly is available, a new assembly is to be prepared using welding consumables from the same batch. If the new assembly is made with the same procedure (particularly the number of runs) as the original assembly, only the duplicate re-test specimens needs to be prepared and tested. Otherwise, all test specimens should be prepared as for re-testing.

3.3.2 Charpy V-notch impact *(1/7/2019)*

Re-test requirements for Charpy impact tests are to be in accordance with Ch 1, Sec 2. Further re-tests may be made at the Surveyor's discretion, but these are to be made on a new welded assembly and are to include all tests required for the original assembly, even those which were previously satisfactory.

4 Covered electrodes for manual arc welding

4.1 General

4.1.1 Grades *(1/7/2019)*

Depending on the results of the Charpy V-notch impact tests, electrodes are divided into the following grades:

- for normal strength steel: Grades 1, 2 and 3
- for higher strength steel with minimum yield strength up to 355 N/mm^2: Grades 2Y and 3Y and 4Y (Grade 1Y not applicable for manual welding)
- for higher strength steels with minimum yield strength up to 390 N/mm^2: Grades 2Y40, 3Y40, 4Y40 and 5Y40.

4.1.2 Hydrogen marks *(1/7/2019)*

If the electrodes are in compliance with the requirements of the hydrogen test given in [4.5], a suffix H15, H10 or H5 will be added to the Grade mark.

4.2 Deposited metal tests

4.2.1 Preparation of deposited metal test assemblies *(1/7/2019)*

Two deposited metal test assemblies are to be prepared in the downhand position as shown in Fig 1, one with 4 mm diameter electrodes and the other with the largest size manufactured. If an electrode is available in one diameter only, one test assembly is sufficient. Any grade of ship structural steel may be used for the preparation of these test assemblies.

The weld metal is to be deposited in single or multi-run layers according to normal practice, and the direction of deposition of each layer is to alternate from each end of the plate, each run of weld metal being not less than 2 mm and not more than 4 mm thick. Between each run, the assembly is to be left in still air until it has cooled to less than 250°C but not below 100°C, the temperature being taken in the centre of the weld, on the surface of the seam. After weld-

Table 4 : Requirements for butt weld test (covered manual electrodes) *(1/7/2019)*

Grade	Tensile strength (transverse test) (N/mm²)	Charpy V-notch impact test		
		Test temperature (C°)	Average Energy J minimum	
			Downhand, horizontal-vertical, overhead	Vertical (upward and downward)
1	400	+ 20	47	34
2		0	47	34
3		- 20	47	34
2Y	490	0	47	34
3Y		- 20	47	34
4Y		- 40	47	34
2Y40	510	0	47	39
3Y40		- 20	47	39
4Y40		- 40	47	39
5Y40		- 60	47	39

4.4 Hot cracking test

4.4.1 *(1/7/2019)*

Hot cracking test may be required at the discretion of the Society.

4.5 Hydrogen test

4.5.1 Hydrogen marks *(1/7/2019)*

At the request of the manufacturer, electrodes may be submitted to a hydrogen test. A suffix H15, H10 or H5 will be added to the grade number to indicate compliance with the requirements of this test.

4.5.2 Execution of hydrogen test *(1/1/2023)*

The mercury method or thermal conductivity detector method according to standard ISO 3690:2018 is to be used. Four weld assemblies are to be prepared. The temperature of the specimens and minimum holding time are to comply with Tab 5, according to the measuring method respectively.

The use of the glycerine method may be admitted at the Society discretion. This method is described hereafter.

Four test specimens are to be prepared, measuring 12 mm by 25 mm in cross section by about 125 mm in length. The parent metal may be any grade of ship structural steel and, before welding, the specimens are to be weighed to the nearest 0.1 g. On the 25 mm surface of each test specimen, a single bead of welding is to be deposited, about 100 mm in length by a 4 mm electrode, fusing 150 mm of the electrode. The welding is to be carried out with an arc as short as possible and with a current of about 150 A.

The electrodes, prior to welding, can be submitted to the normal drying process recommended by the manufacturer. Within 30 seconds of the completion of the welding of each specimen the slag is to be removed and the specimen quenched in water at approximately 20°C.

After 30 seconds in the water, the specimen is to be cleaned and dried, and then placed in an apparatus suitable for the collection of hydrogen by displacement of glycerine. The glycerine is to be kept at a temperature of 45°C during the test. All four specimens are to be welded and placed in individual hydrogen collecting apparatus within a period of time which will limit any variation in hydrogen content due to variation in exposure to moisture absorption following any drying treatment. This should not exceed 30 minutes.

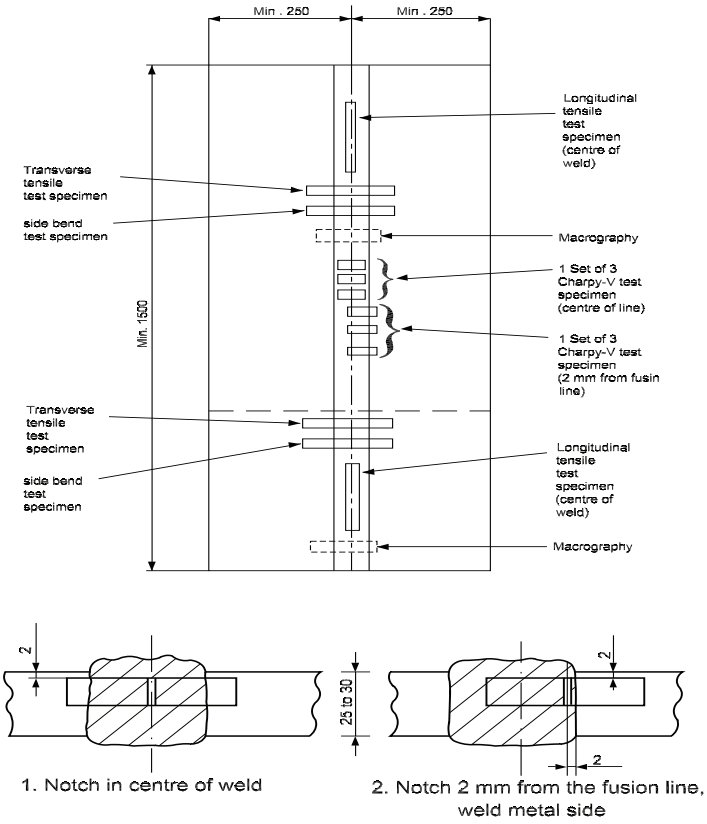
The specimens are to be kept immersed in the glycerine for a period of 48 hours and, after removal, are to be cleaned in water and spirit dried and weighed to the nearest 0.1 g to determine the amount of weld deposit. The amount of gas involved is to be measured to the nearest 0.05 cm³ and corrected for temperature and pressure to 0°C and 760 mm Hg.

Table 5 : Hydrogen test thermal conductivity detector measuring method *(1/7/2019)*

Measuring Method		Test Temperature (°C)	Minimum Holding Time (h)
Thermal Conductivity Detector Method **(1)**	Gas Chromatography	45	72
		150	6

(1) The use of hot carrier gas extraction method may be considered subject to verification of the testing procedure to confirm that collection and measurement of the hydrogen occurs continuously until all of the diffusible hydrogen is quantified.

Figure 10 : Electroslag and electrogas butt weld test assembly *(1/7/2019)*



8 Approval of Welding Consumables for High Strength Steels for Welded Structures

8.1 Application

8.1.1 *(1/7/2019)*

The requirements of this Article apply to consumables used for weldable high strength steels for welded structures with minimum specified yield strength from 420 N/mm^2 to 960 N/mm^2, and impact grades A, D, E and F, except that impact grade F is not applicable for 890 N/mm^2 and 960 N/mm^2 yield strength levels.

Unless otherwise stated in this Article, the requirements relevant to the procedure, tests samples and welding conditions are generally to be in accordance with those of the previous Articles relevant to the approval of consumables for welding normal and higher strength hull structural steels, as follows:

- Article [4]: Covered electrodes for manual metal arc welding;
- Article [5]: Flux-wire combination for submerged arc welding;
- Article [6]: Wires and wire-gas combination for semiautomatic and automatic welding processes employing continuous wire.

The welding consumables preferably to be used for the steels concerned are divided into several categories as follows:

- covered electrodes for manual welding,
- wire-flux combinations for multi-run (see Note 1) submerged arc welding,
- solid wire-gas combinations for arc welding (including rods for gas tungsten arc welding),
- flux cored wire with or without gas for arc welding.

Note 1: Wire-flux combinations for single or two-run technique are subject to special consideration of the Society.

8.2 Grading and designation

8.2.1 *(1/7/2019)*

Based on the yield strength of the weld metal, the welding consumables concerned are divided into eight (yield) strength groups:

- Y42 - for welding steels with minimum yield strength 420 N/mm^2
- Y46 - for welding steels with minimum yield strength 460 N/mm^2
- Y50 - for welding steels with minimum yield strength 500 N/mm^2
- Y55 - for welding steels with minimum yield strength 550 N/mm^2
- Y62 - for welding steels with minimum yield strength 620 N/mm^2

Depending on the type of the welding consumables (and according to the welding process), the butt-weld test pieces called for in this Article is to be welded in a manner analogous to that prescribed in the previous Articles of this Section. The base metal used is to be a high-strength fine-grained structural steel with minimum yield strength and tensile strength matching the consumable grade being approved and compatible with the added symbol for which application is made.

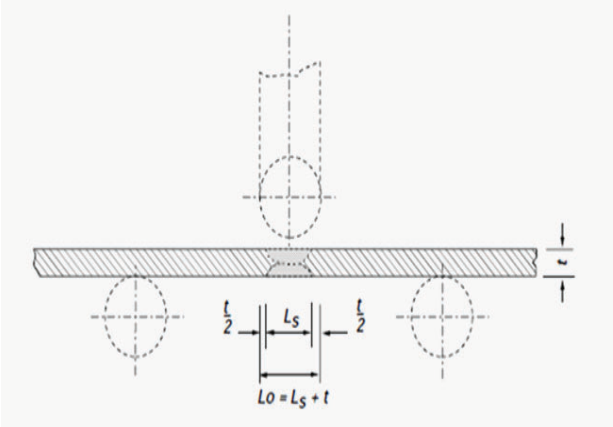
Depending on the type of the welding consumables (and according to the welding process), the test specimens described in the previous Articles of this Section are to be taken from the butt-weld test pieces.

The mechanical properties must meet the requirements stated in Tab 15. The provisions of the previous Articles of this Section apply in analogous manner to the performance of the tests, including in particular the maintenance of the test temperatures in the notched bar impact test and the requirements regarding the retest specimens.

Where the minimum bending angle of 120° required in Tab 15 is not achieved, the specimen may be considered as fulfilling the requirements, if the bending elongation on a gauge length L_o fulfills the minimum elongation requirements stated in Tab 15.

The gauge length $L_o = L_s + t$ (L_s = width of weld, t = specimen thickness), see Fig 11.

Figure 11 : Bending elongation *(1/7/2019)*



8.4 Hydrogen test

8.4.1 *(1/1/2023)*

The welding consumables, other than solid wire-gas combinations, are to be subjected to a hydrogen test in accordance with the mercury method to ISO 3690:2018, or any other method such as the gas chromatographic method which correlates with that method, in respect of cooling rate and delay times during preparation of the weld samples, and the hydrogen volume determinations.

8.4.2 *(1/7/2019)*

The diffusible hydrogen content of the weld metal determined in accordance with the provisions of [4.5] is not to exceed the limits given in Tab 16.

8.5 Annual repeat test

8.5.1 *(1/7/2019)*

The annual repeat tests specified in the previous Articles of this Section are to entail the preparation and testing of weld metal test pieces as prescribed under [8.3.2].

For grades Y69 to Y96 annual hydrogen test is required.

In special cases, the Society may require more extensive repeat tests.

Table 15 : Mechanical properties *(1/7/2019)*

Grade		Tensile test on deposited metal			Tensile test on butt weld	Charpy V-notch impact test		Bend ratio and angle
		Yield stress R_{eH} (N/mm^2) min.	Tensile strength R_m (N/mm^2) min.	Elong. A_5 (%) min.	Tensile strength R_m (N/mm^2) min.	Test temp. (°C)	Minimum average energy (J) **(1)**	D/t **(3)** α **(4)** ≥ 120°
3	Y42	420	520-680	20	520	-20	47	4
4						-40		
5						-60		

(1) Charpy V-notch impact test specimen, mean value of three specimens; for requirements regarding minimum individual values and retests, see [3.2.4] and [3.3.2].

(2) Quality grade 5 is not applicable for Y89 and Y96 grade consumables.

(3) D = mandrel diameter, t = specimen thickness.

(4) Bending angle attained before the first incipient crack, minor pore exposures up to a maximum length of 3mm allowed.

Table 22 : Chemical composition

Grade	Chemical composition (%)					
	C	Mn	Cr	Ni	Mo	Others
308	≤ 0,08	0,5 - 2,5	18 - 21	8 - 11	≤ 0,75	
308L	≤ 0,04	0,5 - 2,5	18 - 21	8 - 11	≤ 0,75	
316	≤ 0,08	0,5 - 2,5	17 - 20	11 - 14	2 - 3	
316L	≤ 0,04	0,5 - 2,5	17 - 20	11 - 14	2 - 3	
316LN	≤ 0,04	0,5 - 2,5	17 - 20	10 - 14	2 - 3	0,15 ≤ N ≤ 0,20
317	≤ 0,08	0,5 - 2,5	17 - 21	11 - 14	2,5 - 4	
317L	≤ 0,04	0,5 - 2,5	17 - 21	11 - 14	2,5 - 4	
309	≤ 0,15	0,5 - 2,5	22 - 26	11 - 15	≤ 0,75	
309L	≤ 0,04	0,5 - 2,5	22 - 26	11 - 15	≤ 0,75	
309Mo	≤ 0,12	0,5 - 2,5	22 - 26	11 - 15	2 - 3	
310	0,08 - 0,20	1,0 - 2,5	25 - 28	20 - 22,5	≤ 0,75	
310Mo	≤ 0,12	1,0 - 2,5	25 - 28	20 - 22	2 - 3	
347	≤ 0,08	0,5 - 2,5	18 - 21	9 -11	≤ 0,75	8xC ≤ Nb+Ta ≤ 1

11.3 Test requirements

11.3.1 *(1/7/2019)*

In the tests for checking the mechanical properties, the requirements specified in Tab 25 are to be met.

For consumables intended for welding Cr-Ni austenitic steels for which the approval is required with the additional symbol BT, the requirements on adsorbed energy in the impact test specified in the table are to be satisfied at the temperature of -196°C.

11.3.2 In the tests for checking the chemical composition of welding consumables intended for Cr-Ni austenitic steels, the limits in percentage specified in Tab 22 are to be satisfied.

In the tests for checking the chemical composition of welding consumables intended for austenitic-ferritic steels, the limits in percentage specified and guaranteed by the Manufacturer are to be satisfied.

11.4 Annual control tests

11.4.1 For the periodical control tests, in addition to the samples and tests for checking the mechanical properties as required for the consumables for welding C and C-Mn steels, the samples for checking the chemical composition are also to be effected.

11.4.2 For the "low C" welding consumables described in [11.2.2], the control tests are limited to one sample of deposited metal and to the checking of the chemical composition.

12 Consumables for welding aluminium alloys

12.1 Application

12.1.1 General *(1/1/2023)*

The requirements of this Article apply to wire or rod-gas combinations to be used for ~~for~~ welding the Al-Mg and Al-Si aluminium alloys specified in Ch 3, Sec 2.

(Unless otherwise stated in this Article, the requirements relevant to the procedure, tests samples and welding conditions are generally to be in accordance with those in Articles [6] relevant to the approval of consumables for welding with continuous wire process).

The welding consumables preferably to be used for the aluminium alloys concerned are divided into two categories, as follows:

a) W = wire electrode and wire gas combination for metal-arc inert gas welding (MIG, 131 according to ISO 4063:2009), tungsten inert gas welding (TIG, 141) or plasma arc welding (PAW, 15)

b) R = rod-gas combinations for tungsten inert gas welding (TIG, 141) or plasma arc welding (PAW, 15).

Note 1: For aluminium welding consumables, there is no unique relationship between the products (wire electrode, wire or rod) and the welding process used (TIG, MIG, PAW). Therefore the wire electrodes, wire or rods, in combination with the relevant shielding gas, will be approved on the basis of the above products form W and R and may be used, as appropriate, for one or more of the above processes.

12.1.2 Grading

The consumables are graded as specified in Tab 23 in accordance with the alloy type and strength level of the base materials used for the approval tests.

SECTION 4 APPROVAL OF WELDING PROCEDURES

1 General

1.1 Application

1.1.1 General *(1/7/2022)*

This Section specifies in Articles [2], [3] and [4] the requirements for the approval of welding procedures for steel materials, and in Article [6] those for aluminium alloys.

The requirements relevant to materials not covered herein are defined on a case-by-case basis following, as far as applicable, the criteria specified in this Section.

Provisions for approval of laser welding procedures of hull structural steels are given in Sec 5.

In the case of applications involving the storage and transport of liquefied gases in bulk and the use of gases or other low-flashpoint fuels, the additional requirements in Ch 2, App 6 apply.

1.1.2 Special requirements

In the case of applications involving the storage and transport of liquefied gases, the requirements of Pt E, Ch 9, Sec 6 apply.

1.2 Welding procedure

1.2.1 Welding processes *(1/1/2023)*

The approval of the welding processes is, as a rule, required for the processes indicated below together with their relevant numbering according to ISO 4063:2009:

- metal arc welding with covered electrode: 111
- submerged arc welding with wire electrode: 121
- flux-cored wire metal arc welding without gas shield: 114
- metal arc inert gas welding (MIG welding): 131
- metal arc active gas welding (MAG welding): 135
- flux-cored wire metal arc welding with active gas shied: 136
- flux-cored wire metal arc welding with inert gas shield: 137
- tungsten inert gas arc welding (TIG welding): 141
- plasma arc welding: 15.

1.2.2 Welding consumables

Consumables approved in accordance with the requirements of Sec 2 are to be used within the limits of their approval.

When non-approved welding consumables are used, the requirements relevant to the qualification of the welding procedures are established on a case-by-case basis.

In any event, tests on a deposited metal sample are required.

Requirements relevant to the grade of welding consumables to be used are given in Sec 2 and, in particular for welding of hull structural steels, in Part B, Chapter 12.

1.2.3 Welding procedure specification *(1/1/2015)*

A welding procedure specification is to be prepared by the Manufacturer and proposed for approval; this document is also referred to as preliminary welding specification (pWPS) and may be modified and amended during the procedure tests as deemed necessary.

In its final version, the welding procedure specification (WPS) is to include all the parameters characterising the welding process (according to ISO 15614 or other recognized standard).

In particular the following parameters are to be included, as applicable:

a) type of welding process and equipment, as appropriate
b) type of joint, preparation and backing material, if any
c) base metal and thickness range
d) filler metal
e) welding position
f) minimum preheat and maximum interpass temperature
g) post-weld heat treatment if applicable
h) shielding gas as applicable
i) welding parameters
j) other information relevant to the welding techniques as applicable.

1.2.4 Welding procedure approval *(1/1/2007)*

Welding procedure tests, according to the proposed pWPS, are to be carried out for the approval of the welding procedure.

The test pieces are to be chosen so as to cover all the production welds in accordance with the approval range of parameters given in [2.7].

The tests for approval of the welding procedure (welding and testing) are to be witnessed by the Surveyor.

The actual parameters used for welding the approval test pieces and the results of the inspections and tests carried out are to be recorded in the WPQR (welding procedure qualification record).

The WPQR is generally prepared by the shipyard or welding shops and is to be signed for validation by the Surveyor.

1.2.5 Certificate of approval of the welding procedure

Upon the satisfactory completion of the approval tests, a certificate of approval of the welding procedure is generally issued by the Society to the individual users, stating the

Part E
Service Notations

Chapter 9
LIQUEFIED GAS CARRIERS

SECTION 5 PROCESS PRESSURE VESSELS AND LIQUID, VAPOUR AND PRESSURE PIPING SYSTEMS

1 General

1.1 Process pressure vessels

1.1.1

IGC CODE REFERENCE : Ch 5, 5.1.2

Process pressure vessels handling cargo are to be considered at least as class 2 pressure vessels, in accordance with Pt C, Ch 1, Sec 3, [1.4.1].

1.1.2 Temperature of steam and heating media within the cargo area *(1/7/2007)*

IGC CODE REFERENCE : Ch 5, 5.1

The maximum temperature of steam and heating media within the cargo area is to be adjusted to take into account the temperature class of the cargoes.

2 Cargo and process piping

2.1 General

2.1.1 *(1/1/2023)*

Cargo pipes, including single wall pipes and inner pipes of double wall arrangements, belong to Class I piping systems, as defined in Pt C, Ch 1, Sec 10, [1.5].

Outer pipes of double wall cargo piping arrangements belong to Class II piping systems, as defined in Pt C, Ch 1, Sec 10, [1.5].

2.1.2 Provisions for protection of piping against thermal stress *(1/1/2021)*

IGC CODE REFERENCE : Ch 5, 5.7.1, 5.11.6.4

Expansion joints are to be protected from extensions and compressions greater than the limits fixed for them and the connected piping is to be suitably supported and anchored. Bellow expansion joints are to be protected from mechanical damage.

The design and installation of expansion bellows is to be in accordance with recognized standards acceptable to the Society.

2.1.3 Segregation of high temperature piping *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.7.2

High temperature pipes are to be thermally isolated from the adjacent structures. In particular, the temperature of pipelines is not to exceed 220 °C in gas-dangerous zones.

2.1.4 Pressure relief valve setting *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.5.6 and 5.5.7

Pressure relief valves are to be set to discharge at a pressure not greater than the design pressure such that the overpressure during discharge does not exceed 110% of the design pressure.

2.1.5 Protection against leakage *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.2

Where the piping system is intended for liquids having a boiling point lower than - 30 °C, permanent means to avoid possibility of contact between leaks and hull structures are to be provided in all those locations where leakage might be expected, such as shore connections, pump seals, flanges subject to frequent dismantling, etc.

2.1.6 Means for detecting the presence of liquid cargo *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.2

The means to detect the presence of liquid cargo may be constituted by electrical level switches whose circuit is intrinsically safe. The alarm signals given by the level switches are to be transmitted to the wheelhouse and to the cargo control station, if provided.

2.1.7 Connections of relief valve discharges to cargo tanks *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.2

The connections, if any, to the cargo tanks of relief valve discharges fitted on the liquid phase cargo piping are not to be fitted with shut-off valves, but are to be provided with non-return valves in the proximity of the tanks.

2.1.8 Centrifugal pumps *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.2

Overpressure relief valves on cargo pumps may be omitted in the case of centrifugal pumps having a maximum delivery head, the delivery valve being completely closed, not greater than that permitted for the piping.

2.2 Scantlings based on internal pressure

2.2.1 Piping scantlings *(1/1/2021)*

IGC CODE REFERENCE : Ch 5, 5.11.2.2, 5.11.2.4 and 5.11.4

Piping systems are to be designed in accordance with recognized standards acceptable to the Society.

The minimum thickness is to be in accordance with recognized standards acceptable to the Society.

2.2.2 Piping subject to green seas *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.11.2.2

In particular for piping subject to green seas, the design pressure P, in bar, in the formula in 5.11.2.2 of the IGC CODE is to be replaced by an equivalent pressure P' given by the following formula:

$$P' = \frac{1}{2}\left(P + \sqrt{P^2 + 0{,}006R'K\frac{D_C}{D}}\right)$$

where:

D_C : External diameter of the pipe taking into account the insulation (in mm), whose thickness is to be taken at least equal to:

40 mm if D ≤ 50 mm

80 mm if D ≥ 150 mm

Intermediate values are to be determined by interpolation.

R' : Drag corresponding to the effect of green seas, in da N/m², such as given in Tab 1 as a function of the location of the pipes and of their height H (in m) above the deepest loadline; intermediate values are to be determined by interpolation.

K : permissible stress, in N/mm²

Table 1

External diameter of pipe **(1)**	Aft of the quarter of the ship's length			Forward of the quarter of the ship's length		
	H ≤ 8	H = 13	H ≥ 18	H ≤ 8	H = 13	H ≥18
≤ 25	1500	250	150	2200	350	150
50	1400	250	150	2000	350	150
75	1100	250	150	1600	350	150
100	700	250	150	700	350	150
≥150	500	250	150	700	350	150

(1) D_C if the pipe is insulated, D otherwise.

2.3 Design pressure

2.3.1 Design pressure definition *(1/1/2021)*

IGC CODE REFERENCE : Ch 5, 5.4.1

For each piping section, the maximum pressure value among those applicable in paragraph 5.11.2.2 of the IGC Code is to be considered.

Higher or lower values of the saturated and superheated vapour pressure at 45°C may be used if agreed upon by the Society.

2.4 Permissible stress

2.4.1 Flanges, valves and fittings *(1/1/2021)*

IGC CODE REFERENCE : Ch 5, 5.11.6.1, 5.11.6.2

For flanges not complying with a standard, the dimensions and type of gaskets are to be to the satisfaction of the Society.

Flanges are to be selected as to type, made and tested in accordance with the Pt C, Ch 1, Sec 10.

2.5 Stress analysis

2.5.1 Calculations in accordance with recognised standards *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.11.5

When such an analysis is required, it is to be carried out in accordance with the requirements listed below. Subject to this condition, calculations in accordance with recognised standards are admitted by the Society.

2.5.2 Calculation cases *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.11.5

The calculations are to be made for every possible case of operation, but only those leading to the most unfavourable results are required to be submitted.

2.5.3 Loads to be taken for calculation *(1/1/2021)*

IGC CODE REFERENCE : Ch 5, 5.11.5

The calculations are to be carried out taking into account the following loads:

a) piping not subject to green seas:
- pressure
- weight of the piping with insulation and internal medium
- contraction

b) piping subject to green seas that is liable to be in operation at sea and in port:
- pressure
- weight of the piping with insulation and internal medium
- green seas
- contraction
- ship motion accelerations

c) piping subject to green seas that is in operation only in port; the more severe of the following two combinations of loads:
- pressure
- weight of the piping with insulation and internal medium
- contraction

and
- weight of the piping
- green seas
- expansion, assuming that the thermal stresses are fully relaxed.

2.5.4 Green sea directions *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.11.5

When green seas are considered, their effects are to be studied, unless otherwise justified, in the following three directions:

- axis of the ship
- vertical
- horizontal, perpendicular to the axis of the ship. The load on the pipes is the load R' defined in [2.2.2].

2.5.5 Stress intensity *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.11.5

The stress intensity is to be determined as specified in the formulae in Pt C, Ch 1, Sec 10, [2.3.2] for pipes intended for high temperatures:

a) for primary stresses resulting from:
   - pressure
   - weight
   - green seas

b) for primary stresses and secondary stresses resulting from contraction.

2.5.6 Stress intensity limits *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.11.5

a) For the first case, the stress intensity is to be limited to the lower of:

   $0,8\ R_e$ and $0,4\ R_m$

b) For the second case, the stress intensity is to be limited to the lower of:

   $1,6\ R_e$ and $0,8\ R_m$.

2.5.7 Piping with expansion devices *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.11.5

For piping fitted with expansion devices, their characteristics are to be submitted to the Society. Where these characteristics are such that the forces and moments at the ends of the devices are negligible for the contraction they must absorb, the calculation of the loads due to contraction in the corresponding piping is not required. It is, however, to be checked that the stress intensity corresponding to the primary stresses does not exceed the limits given in [2.5.6].

2.5.8 Flexibility coefficient *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.11.5

The flexibility coefficient of elbows is to be determined from the formulae given in Pt C, Ch 1, Sec 10, [2.3.2] for pipes intended for high temperatures.

2.5.9 Local stresses *(1/1/2020)*

IGC CODE REFERENCE : Ch 5, 5.11.5

Particular attention is to be paid to the calculation of local stresses in the assemblies subjected to axial forces and bending moments. The Society reserves the right to request additional justifications or local strengthening where considered necessary.

2.6 Materials

2.6.1 *(1/1/2023)*

IGC CODE REFERENCE : Ch 5, 5.12

Aluminised pipes may be fitted in ballast tanks, in inerted cargo tanks and, provided the pipes are protected from accidental impact, in hazardous areas on open deck.

For an outer pipe or duct equipped with mechanical exhaust ventilation having a capacity of at least 30 air changes per hour, the effects of both pressure and possible low temperature in the event of a high pressure line failure shall be taking into account.

Tests for materials are required for all cargo pipes belonging to Class I irrespective of their diameter.

Materials of outer pipes belonging to Class II are to be tested according to the Pt C, Ch 1, Sec 10, Table 36.

2.7 Piping fabrication and joining details

2.7.1 *(1/1/2021)*

IGC CODE REFERENCE : Ch 5, 5.8

The Society may accept relaxations, based on recognized standards, from the requirements in IGC Code, 5.8 for piping inside cargo tanks and open ended piping.

Acceptance of types of piping connections other than those mentioned in IGC Code, 5.8 may be considered by the Society case by case.

2.8 Welding, post-weld heat treatment and non-destructive testing

2.8.1 *(1/1/2023)*

IGC CODE REFERENCE : Ch 5, 5.9

For post-weld heat treatments, the Society may waive the requirement for thermal stress relieving for pipes having a wall thickness less than 10 mm in relation to the design temperature and pressure of the concerned piping system.

For outer pipes of double wall cargo piping arrangements non-destructive testing are to be carried out according to IGC Code 5.9.3.

For butt-welded joints of pipes not covered by IGC Code 5.9.3.2 spot radiographic controls or other non-destructive controls are to be carried out at the discretion of the Society depending upon service, position and materials.

3 Tests of piping components and pumps prior to installation on board

3.1 Valves

3.1.1 Prototype Testing *(1/1/2021)*

IGC CODE REFERENCE : Ch 5, 5.13

For safey valves that are subject to IGC Code para. 8.2.5, the flow or capacity are to certified by the Society; for other types of valves, the manufacturer is to certify the flow properties of the valves based on tests carried out according to recognized standards.

For emergency shutdown valves, with materials having melting temperatures lower than 925°C, the type testing shall include a fire test to a standard acceptable to the Society.

Part E
Service Notations

Chapter 11
PASSENGER SHIPS

SECTION 5 ELECTRICAL INSTALLATIONS

1 General

1.1 Application

1.1.1 *(1/7/2007)*

As stated in Note 1 of Pt A, Ch 1, Sec 1, [1.1.2], the statutory requirements of the SOLAS Convention and/or national safety regulations, as applicable, regarding fire protection, detection and extinction (hereinafter referred to as "fire protection statutory requirements") are no longer mandatory for the purpose of classification, except where the Society carries out surveys relevant to fire protection statutory requirements on behalf of the flag Administration. In such cases, fire protection statutory requirements are considered a matter of class and therefore compliance with these requirements is also verified by the Society for classification purposes.

1.2 Documentation to be submitted

1.2.1 The documentation dealing with the electrical system for watertight door and fire door systems (see [1.1.1]) is to be submitted for approval.

1.3 Electrical distribution and protection

1.3.1 *In a passenger ship, distribution systems shall be so arranged that fire in any main vertical zone as defined in* Part C, Chapter 4 *will not interfere with services essential for safety in any other such zone.*

This requirement will be met if main and emergency feeders passing through any such zone are separated both vertically and horizontally as widely as is practicable.

1.3.2 For generators arranged to operate in parallel and for individually operating generators, arrangements are to be made to disconnect automatically the excess load when the generators are overloaded in such a way as to prevent a sustained loss of speed. The operation of such device is to activate a visual and audible alarm.

1.3.3 *(1/7/2010)*

In passenger ships, supplementary lighting shall be provided in all cabins to clearly indicate the exit so that occupants will be able to find their way to the door. Such lighting, which may be connected to an emergency source of power or have a self-contained source of electrical power in each cabin, shall automatically illuminate when power to the normal cabin lighting is lost and remain on for a minimum of 30 min.

2 Emergency source of electrical power and emergency installations

2.1 General

2.1.1 *A self-contained emergency source of electrical power shall be provided.*

2.1.2 *Provided that suitable measures are taken for safeguarding independent emergency operation under all circumstances, the emergency generator may be used, exceptionally, and for short periods, to supply non-emergency circuits.*

Exceptionally, whilst the vessel is at sea, is understood to mean conditions such as:

a) blackout situation

b) dead ship situation

c) routine use for testing

d) short-term parallel operation with the main source of electrical power for the purpose of load transfer.

Unless instructed otherwise by the Society, the emergency generator may be used during lay time in port for the supply of the ship mains, provided the requirements of Pt C, Ch 2, Sec 3, [2.4] are complied with.

2.1.3 *The electrical power available shall be sufficient to supply all those services that are essential for safety in an emergency, due regard being paid to such services as may have to be operated simultaneously.*

2.1.4 *The emergency source of electrical power shall be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the services stated in* [2.2.3] *for the period specified, if they depend upon an electrical source for their operation.*

2.1.5 *The transitional source of emergency electrical power, where required, is to be of sufficient capacity to supply at least the services stated in* [2.2.7] *for the periods specified therein, if they depend upon an electrical source for their operation.*

2.1.6 *An indicator shall be mounted in a suitable place on the main switchboard or in the machinery control room to indicate when the batteries constituting either the emergency source of electrical power or the transitional source of emergency electrical power referred to in* Pt C, Ch 2, Sec 3, [2.3.13] *and* Pt C, Ch 2, Sec 3, [2.3.14] *are being discharged.*

2.1.7 If the services which are to be supplied by the transitional source receive power from an accumulator battery by means of semiconductor converters, means are to be provided for supplying such services also in the event of failure

of the converter (e.g. providing a bypass feeder or a duplication of converter).

2.1.8 *Where electrical power is necessary to restore propulsion, the capacity of the emergency source shall be sufficient to restore propulsion to the ship in conjunction to other machinery as appropriate, from a dead ship condition within 30 min. after blackout.*

For the purpose of this requirement only, the dead ship condition and blackout are both understood to mean a condition under which the main propulsion plant, boilers and auxiliaries are not in operation and in restoring the propulsion, no stored energy for starting the propulsion plant, the main source of electrical power and other essential auxiliaries is to be assumed available. It is assumed that means are available to start the emergency generator at all times.

The emergency generator and other means needed to restore the propulsion are to have a capacity such that the necessary propulsion starting energy is available within 30 minutes of blackout/dead ship condition as defined above. Emergency generator stored starting energy is not to be directly used for starting the propulsion plant, the main source of electrical power and/or other essential auxiliaries (emergency generator excluded).

For steam ships, the 30 minute time limit given in SOLAS can be interpreted as the time from blackout/dead ship condition defined above to light-off of the first boiler.

2.1.9 *Provision shall be made for the periodical testing of the complete emergency system and shall include the testing of automatic starting arrangements.*

2.1.10 For starting arrangements of emergency generating sets, see Pt C, Ch 1, Sec 2, [5.1].

2.1.11 *The emergency source of electrical power may be either a generator or an accumulator battery, which shall comply with the provisions of* [2.1.12] *or* [2.1.13]*, respectively.*

2.1.12 *Where the emergency source of electrical power is a generator, it shall be:*

(a) driven by a suitable prime mover with an independent supply of fuel having a flashpoint (closed cup test) of not less than 43°C;

(b) started automatically upon failure of the electrical supply to the emergency switchboard *from the main source of electrical power and shall be automatically connected to the emergency switchboard; those services referred to in* [2.2.7] *shall then be transferred automatically to the emergency generating set. The automatic starting system and the characteristic of the prime mover shall be such as to permit the emergency generator to carry its full rated load as quickly as is safe and practicable, subject to a maximum of 45 s; and*

(c) provided with a transitional source of emergency electrical power according to [2.1.14].

2.1.13 *Where the emergency source of electrical power is an accumulator battery, it shall be capable of:*

(a) carrying the emergency electrical load without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage;

(b) automatically connecting to the emergency switchboard in the event of failure of the main source of electrical power; and

(c) immediately supplying at least those services specified in [2.2.7].

2.1.14 *The transitional source of emergency electrical power required by* [2.1.12] (c) *shall consist of an accumulator battery which shall operate without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage and be so arranged as to supply automatically in the event of failure of either the main or emergency source of electrical power at least the services in* [2.2.7] *if they depend upon an electrical source for their operation.*

2.2 Distribution of electrical power

2.2.1 *The emergency switch board shall be supplied during normal operation from the main switchboard by an interconnector feeder which shall be adequately protected at the main switchboard against overload and short-circuit and which is to be disconnected automatically at the emergency switchboard upon failure of the main source of electrical power.*

Where the system is arranged for feedback operation, the interconnector feeder is also to be protected at the emergency switchboard at least against short-circuit.

2.2.2 *In order to ensure ready availability of the emergency source of electrical power, arrangements shall be made where necessary to disconnect automatically non-emergency circuits from the emergency switchboard to ensure that power shall be available to the emergency circuits.*

2.2.3 *(1/1/2023)*

The emergency source of electrical power shall be capable of supplying simultaneously at least the following services for the periods specified hereafter, if they depend upon an electrical source for their operation:

a) for a period of 36 hours, emergency lighting:

1) at every muster and embarkation station and over the sides;

2) in alleyways, stairways and exits giving access to the muster and embarkation stations;

3) in all service and accommodation alleyways, stairways and exits, personnel lift cars;

4) in the machinery spaces and main generating stations including their control positions;

5) in all control stations, machinery control rooms, and at each main and emergency switchboard;

6) at all stowage positions for firemen's outfits;

7) at the steering gear; and

8) at the fire pump, the sprinkler pump and the emergency bilge pump referred to in (d) below and at the starting position of their motors;

9) in all cabins, unless this supplementary lighting has a self-contained source of electrical power in each cabin (see [1.3.3])

b) for a period of 36 hours:

1) the navigation lights and other lights required by the International Regulations for Preventing Collisions at Sea in force; and

2) on ships constructed on or after 1 February 1995 the VHF radio installation required by Regulation IV/7.1.1 and IV/7.1.2 of SOLAS Consolidated Edition 1992, and, if applicable:

- *the MF radio installation required by Regulations IV/9.1.1, IV/9.1.2, IV/10.1.2 and IV/10.1.3;*
- *the ship earth station required by Regulation IV/10.1.1; and*
- *the MF/HF radio installation required by Regulations IV/10.2.1, IV/10.2.2 and IV/11.1;*

c) for a period of 36 hours:

1) all internal communication equipment required in an emergency (see [2.2.4]*);*

2) the shipborne navigational equipment as required by Regulation V/12; where such provision is unreasonable or impracticable the Head Office may waive this requirement for ships of less than 5,000 tons gross tonnage;

3) the fire detection and fire alarm system, the fire door holding and release system (see *[1.1.1]); and*

4) intermittent operation of the daylight signalling lamp, the ship's whistle, the manually operated call points and all internal signals (see [2.2.5]) *that are required in an emergency~~, unless such services have an independent supply for the period of 36 hours from an accumulator battery suitably located for use in an emergency~~;*

unless such services have an independent supply for the period of 36 hours from an accumulator battery suitably located for use in an emergency;

d) for a period of 36 hours:

1) one of the fire pumps required by the relevant provisions of Part C, Chapter 4 (see [1.1.1]*);*

2) the automatic sprinkler pump, if any [1.1.1]); and

3) the emergency bilge pump and all the equipment essential for the operation of electrically powered remote controlled bilge valves;

e) for the period of time required in Pt C, Ch 1, Sec 11, [2]*, the steering gear if required to be so supplied;*

f) for a period of half an hour:

1) any watertight doors required by Regulation II-1/15 to be power operated together with their indicators and warning signals;

2) the emergency arrangements to bring the lift cars to deck level for the escape of persons. The passenger lift cars may be brought to deck level sequentially in an emergency.

Note 1: For ships having navigation notation "sheltered area" or "special navigation" having an area of operation at not more than 6 miles from the shore (see Pt C, Ch 2, Sec 1, [1.1.3]) and not subject to the SOLAS convention, the Society may accept that the emergency source of electrical power is capable of supplying, for a period of not less than 2 times the expected duration of the longest voyage, but not less than:

- *3 hours, or*
- *30 minutes for ships having navigation notation "sheltered area",*

only the following services:

- *emergency lighting*
- *navigation lights;*
- *radio installation;*
- *internal communication equipment and general alarm system;*
- *fire detection and alarm system;*
- *the steering gear pump (where it is required to be so supplied);*
- *one of the fire pumps;*
- *power to the control, indication and alarm circuits of watertight and fire doors (where provided);*
- *the sprinkler pump;*
- *the emergency bilge pump.*

2.2.4 *(1/7/2007)*

Internal communication equipment required in an emergency generally includes:

a) the means of communication between the navigating bridge and the steering gear compartment

b) the means of communication between the navigating bridge and the position in the machinery space or control room from which the engines are normally controlled

c) the means of communication which is provided between the officer of the watch and the person responsible for closing any watertight door which is not capable of being closed from a central control station

d) the public address system or other effective means of communication throughout the accommodation, public and service spaces (see [1.1.1])

e) the means of communication between the navigating bridge and the main fire control station.

SECTION 4 ~~COMFORT WITH REGARD TO~~ NOISE EMISSIONS IN PORT AREA OUTBOARD AND INBOARD

1 General

1.1 Application

1.1.1 *(1/1/2023)*

~~COMF~~ **NOISE-PORT-OUT(X)** **and NOISE-PORT-IN(X)** notations, in accordance with Pt A, Ch 1, Sec 2, [6.7.5], ~~is~~are assigned to ships classed by the Society and complying with the requirements of this Section. In the event that the ship undergoes modifications, refitting or repairs that may affect its level of comfort, the maintenance of the notations is subject to the results of new measurements as deemed appropriate by the Society. The notations ~~is~~are completed by a number (1-100) which represents the merit level achieved for the assignment of the notations, the merit 100 corresponding to the lowest level of noise.

The notations ~~COMF~~ **NOISE-PORT-OUT(X)** **and NOISE-PORT-IN(X)** ~~is~~are assigned when noise measurements are carried out in port area outboard and in board respectively, and only ~~assigned~~ if at least merit level 1 is reached.

1.1.2 *(1/1/2020)*

Ships not classed by the Society complying with the requirements of this Section are provided with a Certificate of Conformity which attests their comfort quality. The Certificate is valid for a period of 5 years and may be extended, at the request of the Owner, for an additional 5-year period based on a limited set of measurements covering at least 5% of those made when the Certificate was first issued.

1.1.3 *(1/1/2020)*

The requirements apply to conventional passenger and cargo ships irrespective of the ship's age, as far as reasonable and practicable, to the satisfaction of the Society.

1.2 Basic principles

1.2.1 *(1/1/2020)*

The requirements of this Section define the limits of acceptability of noise in port area, the methods for verification of compliance and the criteria for acceptance. They are based, as appropriate, on international standards and are deemed to preserve the general principles of such standards.

1.2.2 *(1/1/2023)*

For **NOISE-PORT-OUT(X)** notation, verification of compliance is based on the measurements of noise levels outside the ship at a distance of 100m.

1.2.3 *(1/1/2023)*

For **NOISE-PORT-IN(X)** notation, verification of compliance is based on the measurements of noise sources and an extrapolation of noise levels outside the ship at a distance of 100m.

1.2.~~2~~4 *(1/1/2023)*

~~Verification of compliance is based on the measurements of noise levels outside the ship at a distance of 100m.~~ These measurements are to be carried out either by a Surveyor of the Society or by a technician from a company recognized as suitable by the Society. In the latter case, measurements are to be performed under the surveillance of a Surveyor of the Society.

2 Definitions

2.1 Noise

2.1.1 *(1/1/2023)*

Noise is the audible sound wave level, generally of a random nature, in the 20 to 18000 Hz frequency range. As far as compliance with the requirements of this Section is concerned, noise is measured in the ~~31,5~~25 to ~~8~~10000 Hz frequency range unless otherwise specified by the Society in special cases.

2.1.2 *(1/1/2023)*

For the purposes of this Section, A-weighted noise levels are considered, measured in dB(A) by:

- a precision sound level meter with an accuracy grade of about ± 1 dB, for the **NOISE-PORT-OUT(X)** notation; and
- a precision sound intensity measurement instrument and probe class 1, for the **NOISE-PORT-IN(X)** notation.

3 Documentation to be submitted

3.1 Measurement plan

3.1.1 *(1/1/2023)*

The proposed measurement plan is to be submitted for information well in advance of the measurement campaign. The measurement plan ~~should~~is to provide information (position, technical data sheets, etc.) of all possible noise sources during the described measurement condition.

3.2 Noise measurement results

3.2.1 *(1/1/2020)*

A detailed measurement report is to be submitted for approval.

4 Noise levels: testing conditions and acceptance criteria

4.1 General Testing conditions

4.1.1 ~~General~~ *(1/1/2020)*

Noise levels are to be measured according to:

- ISO 2922:2000 for **NOISE-PORT-OUT(X)** notation; and
- UNI EN ISO 9614-2:1988 for **NOISE-PORT-IN(X)** notation

in the conditions defined below. Different conditions may be accepted as equivalent at the discretion of the Society.

4.1.2 ~~General~~ *(1/1/2020)*

During measurements, all auxiliary systems, forced ventilation and air conditioning systems (HVAC systems) and hotel service systems are to be operating in idle conditions; as noise arising from every kind of human activity (included cargo load and unload) is to be avoided, in general only the personnel needed for the operation of the ship hotel activities and those carrying out the measurements are to be present. During measurements all passenger entertainment systems are to be switched off.

4.1.3 ~~General~~ *(1/1/2023)*

~~As far as practicable the ship position should be the worst possible one from the acoustic point of view (e.g. with noise sources facing the port area). The position during test should be reported in the measurement report~~In general, only the personnel needed for the operation of the ship hotel activities and those carrying out the measurements are to be present. During measurements all passenger entertainment systems are to be switched off.

4.1.4 ~~General~~ *(1/1/2020)*

In general, meteorological conditions are to be within the following limits:

- wind: not stronger than Beaufort 4 - strong breeze (speed 11 to 16 knots).

4.1.5 ~~Propulsive Power~~ *(1/1/2020)*

The vessel is to be at rest in port with the propulsion engines switched off and only the minimum number of necessary auxiliary systems running. Engine room ventilation is to be running in normal mode.

Different conditions may be considered if accepted as equivalent for the purpose of the requirements at the discretion of the Society.

4.1.6 ~~Other equipment~~ *(1/1/2020)*

All machineries necessary for cargo (such as garage ventilation fans for Ro-Ro Ships, Refeers fans for Container ships, etc.) are running in normal mode.

Subject to the acceptance of the Society and to the agreement of the interested party, equipment such as bow thrusters, stabilizing fins etc. is to be operating during measurements, if it is necessary for the ship in normal operating conditions and in the environmental conditions specified in [4.1.4].

With the above-mentioned equipment operating, special consideration may be given by the Society concerning the acceptable noise levels.

4.2 Measurement positions

4.2.1 NOISE-PORT-OUT(X) measurement position *(1/1/2023)*

Measurements are to be carried out in correspondence of the potential noise sources (exhaust funnel outlets of the auxiliary engines, outlet fan/ventilation, pumps, compressors, public address systems, etc~~t~~.) according to the following principles.

At the discretion of the Society, additional measurements are to be performed to establish the extension of area with excessive noise levels.

~~**4.2.2** *(1/1/2020)*~~

a) Measurements should be carried out at a distance of 100 m from the ship surface. All measurement points shall be at least 4 m above the sea surface.

~~**4.2.3** *(1/1/2020)*~~

b) If, for logistical or geographical reasons, such a distance (100 m) from the ship is not practicable, a different distance could be considered. The measured data will be corrected for distance in the post processing phase as described in [5.3].

c) As far as practicable the ship position should be the worst possible one from the acoustic point of view (e.g. with noise sources facing the port area). The position during test is to be reported in the measurement report.

4.2.2 NOISE-PORT-IN(X) measurement position *(1/1/2023)*

Measurements are to be carried out in correspondence of the potential noise sources (exhaust funnel outlets of the auxiliary engines, outlet fan/ventilation, pumps, compressors, public address systems, etc.) according to the following principles:

a) Sound intensity measurements of noise sources could be carried out both in port and at anchor.

4.3 Instrumentation

4.3.1 *(1/1/2023)*

Noise level measurements are to be carried out:

- for **NOISE-PORT-OUT(X)** notation, by means of integrating-averaging sound precision level meters. These sound level meters are to comply with IEC 60942 (2003-01) or a standard accepted as equivalent by the Society.
- for **NOISE-PORT-IN(X)** notation, by means of intensity probe. The intensity probe has to comply with IEC 1043 or a standard accepted as equivalent by the Society.

This compliance is to be verified according to ISO 17025 (2005) at least every two years by an organization recognized by the Society.

The date of last verification and confirmation of compliance with relevant IEC standards is to be recorded. Calibration sheets are to b~~1~~e provided.

4.4 Measurement procedure NOISE-PORT-OUT(X)

4.4.1 *(1/1/2020)*

Distance measurement is required to determine the distance between the ship surface and the measurement point. If such a distance will be different from 100 m a correction, during the post processing phase, will be applied [5.3].

4.4.2 *(1/1/2020)*

Measurements are to be carried out to estimate the sound pressure levels LAeq by averaging the noise level during at least 15 s with the time-weighting slow (S). If the sound is irregular with fluctuations exceeding ± 3 dB(A), the measuring time is to be extended to at least 30 s. The measured value is to be rounded to the nearest integer. Noise level is to be measured in dB (A) units with the A-weighting curve.

4.4.3 *(1/1/2020)*

The recommended distance between the ship hull side/stern and the microphone should be 100 m. The vessel side should be directly exposed to the microphone, no barriers should be placed between the source (ship) and the receiver (microphone).

4.4.4 *(1/1/2023)*

At least three (3) noise measurements for each side (starboard and portside) of the vessel ~~should~~are to be carried out. One point should be in correspondence of the Midship Perpendicular, the others two ¼ of the ship overall length fore and aft the Midship Perpendicular.

4.4.5 *(1/1/2023)*

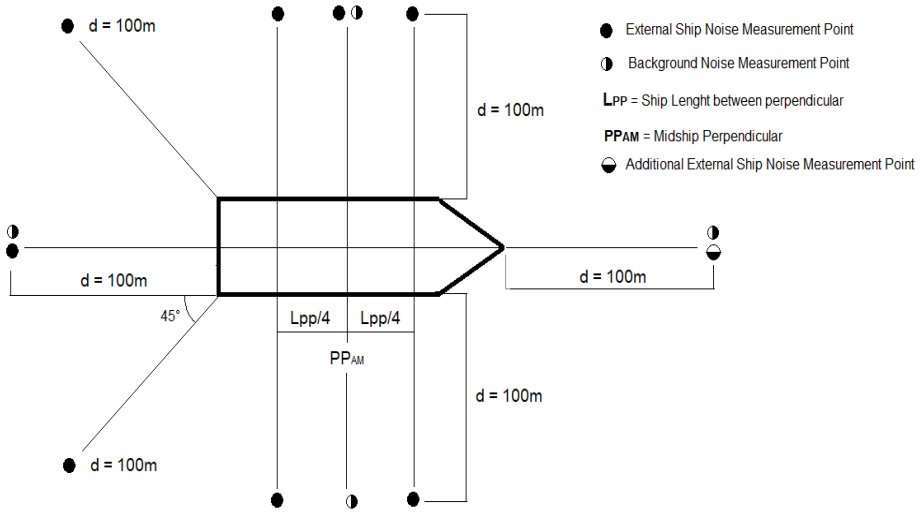
At least one (3) noise measurement for the aft part of the vessel ~~should~~are to be carried out. One point should be in correspondence of the center line, the others two in correspondence of the stern edges (one starboard side, one port side) as described in the following figure.

4.4.6 *(1/1/2020)*

One (1) additional point could be measured in correspondence of the bow of the vessel if a significant noise from the fore part is present. In any case, the additional fore measurement point could be requested at the discretion of the Society during measurements.

In case the additional measurement point is requested, a background noise measurement in the same position should also be carried out.

Figure 1 *(1/1/2020)*



4.4.7 *(1/1/2020)*

The resulting data set will be composed by:

- $L_{Aeq,S,n}$ = Starboard side measurement at 100 m from the hull side. Where n = 1, 2, 3 (number of measurements for each side)
- $L_{Aeq,P,n}$ = Port side measurement at 100 m from the hull side. Where n = 1, 2, 3 (number of measurements for each side)
- $L_{Aeq,A,n}$ = Aft part measurement at 100 m from the hull side. Where n = 1, 2, 3 (number of measurements for stern area)

4.4.8 *(1/1/2020)*

The background noise is the noise from all acoustical and non-acoustical sources when the ship is not present.

A background noise recording ($L_{Aeq,BG}$) has to be carried out before or after the noise measurements.

At least one background noise measurement for each side of the vessel and one for the stern area are required.

4.5 Measurement procedure NOISE-PORT-IN(X)

4.5.1 *(1/1/2023)*

As described in ISO 9614-2 (1998), the measurements are to be performed by continuous averaging over the surface area (both horizontally and vertically) of the noise source. Both manual and mechanical scan are accepted. The manual scan is to take place with a speed of between 0,1 m/s and 0,5 m/s, the mechanical with a speed of between 0 m/s and 1 m/s.

The averaging time for each segment is not to be shorter than 20 s.

4.5.2 *(1/1/2023)*

If the averaging surface is divided into several segments, the averaging needs to be performed subsequently for all segments.

4.5.3 *(1/1/2023)*

Where many sources of the same type are present, at least three sources should be measured. Sources to be measured will be presented in the measurement plan and should be the most representative ones. At discretion of the Society additional or different noise sources could be measured.

4.5.4 *(1/1/2023)*

The resulting data set will be composed by the A-weighted sound intensity level (L_{AIn}) with I_0 reference = 10^{-12} Wm^{-2} for each 1/3 octave band frequency in the range 25 - 10k Hz.

4.5.5 *(1/1/2023)*

The background noise is the noise from all acoustical and non-acoustical sources when the noise source is switched off.

As far as possible, a background noise recording ($L_{AI,BG}$) has to be carried out to correct the sound power level before or after the noise measurements of each measured source.

5 Post processing

5.1 Introduction

5.1.1 *(1/1/2020)*

When the testing is completed, post processing is required to adjust sound pressure level spectra for background noise, distance and to combine multiple measurements.

5.2 Background noise adjustments

5.2.1 *(1/1/2023)*

The signal plus noise to noise ratio, or ΔL, is defined as follow for each measurement:

$\Delta L = L_{Aeq,n} - L_{Aeq,BG}$

where:

$L_{Aeq,n}$ = measured sound pressure or intensity level measured

$L_{Aeq,BG}$ = measured background noise or intensity level in the corresponding point of measurement.

5.2.2 *(1/1/2023)*

If ΔL is greater than 10 dB, then no adjustments are necessary. If ΔL is between 3 and 10 dB and if the background noise is sufficiently stationary, then adjustments to the measurements are required.

The adjustment consists in subtracting the following coefficient K_1 to the measured sound pressure or sound intensity level.

$K_1 = -10\log(1-10^{-10\Delta L})$

5.2.3 *(1/1/2020)*

It is to be clearly identified in the report that such corrections have been applied. If ΔL is less than 3 dB then the data are to be so noted or discarded.

5.3 Additional post processing for NOISE-PORT-OUT(X) notation ~~Distance normalization~~

5.3.1 Distance normalization *(1/1/2023)*

The final adjustment is normalization for distance. The typical distance from the ship to the measurement point is 100 m. However, because of logistical and geographical reasons, this distance may vary.

~~**5.3.2** *(1/1/2020)*~~

The distance normalized sound pressure level is determined by adding to the measured sound pressure level the following coefficient K_2.

$K_2 = 20\log(d/d_{ref})$

where:

d = is the distance from the ship under test to measuring point (meters);

d_{ref} = reference distance of 100 m

~~5.4 SPL measurements combination~~

5.34.21 SPL measurements combination *(1/1/2023)*

The multiple measurements are to be combined through an energetic mean of the recorded sound pressure levels A-weighted.

~~**5.4.2** *(1/1/2020)*~~

The first step is to determine the average of the sound pressure level A weighted from all three measurements at the same side/stern of the ship.

$$L_{Aeq,S} = 10\log\left[\frac{1}{N}\Sigma_n 10^{\frac{L_{Aeq,S,n}}{10}}\right]$$

$$L_{Aeq,P} = 10\log\left[\frac{1}{N}\Sigma_n 10^{\frac{L_{Aeq,P,n}}{10}}\right]$$

$$L_{Aeq,A} = 10\log\left[\frac{1}{N}\Sigma_n 10^{\frac{L_{Aeq,A,n}}{10}}\right]$$

where:

$L_{Aeq,S}$ = A-weighted averaged starboard side sound pressure level.

$L_{Aeq,P}$ = A-weighted averaged portside sound pressure level.

$L_{Aeq,A}$ = A-weighted averaged aft area sound pressure level.

$L_{Aeq,S,n}$ = A-weighted starboard side sound pressure level measurements at 100 m from the hull side at the requested positions in [4.4.4]. This value is already post processed for background noise and distance.

$L_{Aeq,P,n}$ = A-weighted portside sound pressure level measurements at 100 m from the hull side at the requested positions in [4.4.4]. This value is already post processed for background noise and distance.

$L_{Aeq,A,n}$ = A-weighted aft area sound pressure level measurements at 100 m from the stern at the requested positions in [4.4.5].

N= number of measurement at each side of the ship. As described in [4.4.4] and [4.4.5]. N should be at least three (3).

~~**5.4.3** *(1/1/2020)*~~

The final A-weighted sound pressure level (L_{Aeq}) is an average between the two sides averaged sound pressure levels and the aft side averaged sound pressure level.

$$L_{Aeq} = 10\log\left[\frac{1}{3}\left(10^{\frac{L_{Aeq,S}}{10}} + 10^{\frac{L_{Aeq,P}}{10}} + 10^{\frac{L_{Aeq,A}}{10}}\right)\right]$$

where:

$L_{Aeq,S}$ = A-weighted averaged starboard side sound pressure level.

$L_{Aeq,P}$ = A-weighted averaged portside sound pressure level.

$L_{Aeq,A}$ = A-weighted averaged aft part sound pressure level.

5.4 Additional post processing for NOISE-PORT-IN(X) notation

5.4.1 Sound Power Level Calculation *(1/1/2023)*

The sound power level of the specific sound source (i) will be calculated in accordance with UNI EN ISO 9614-2 (1998).

For each 1/3 octave frequency band in the range 25 Hz to 10 kHz the following formula should be used:

$$L_{WA,i} = L_{AI,i} - K + 10 \cdot \log\left(\frac{S_i}{S_0}\right)$$

where:

$L_{WA,i}$ is the calculated sound power level of the (i) noise source

$L_{AI,i}$ is the measured sound intensity level of the (i) noise source

K is the background noise correction (see [5.2])

S_i is the area of the measurement surface in [m]

S_0 is the reference surface of 1 m

The multiple measurements are to be combined through an energetic mean of the recorded sound pressure levels A-weighted.

The total sound power level will be calculated from the calculated sound power level of all individual sound sources for each 1/3 octave frequency band from 25 Hz to 10 kHz.

Noise sources of the same type measured in different positions around the ship should be combined using an energetic average, as follow:

$$L_{WA,source} = 10 \cdot \log\left(\frac{1}{N} \cdot 10^{\frac{L_{WA,n}}{10}}\right)$$

where:

$L_{WA,source}$ = average sound power level of the noise source type

N = number of sources of the same type

$L_{WA,n}$ = measured sound pressure level of the noise sources of the same type

Average sound power level will be repeated for all noise sources of the same type in the total sound power level calculation in [5.4.1].

5.4.2 SWL measurement combination *(1/1/2023)*

The calculated sound power levels A-weighted for each source are to be summed as follow:

$$L_{WA,total} = 10 \cdot \log\left(\sum_i 10^{\frac{L_{WA,i}}{10}}\right)$$

The result of the combination will be:

$L_{WA,total}$= the total sound power level calculated in the range 25-10k Hz for each 1/3 frequency.

The broadband total sound power level will be calculated by the energetic sum of the total sound power levels for all 1/3 octave frequency bands from 25 Hz to 10 kHz ($L_{WA,total,broadband}$).

5.4.3 Propagation *(1/1/2023)*

To assign the class notation a free field propagation of the total sound pressure level at 100 m should be performed. A spherical propagation is supposed.

$$L_{Aeq} = L_{WA,total,broadband} - 10 \cdot \log(4 \cdot \pi \cdot r^2)$$

Where

L_{Aeq}= the total overall sound pressure level at 100 m, supposing a spherical propagation in free field conditions

$L_{WA,total,broadband}$ = the total sound power level calculated in the range 25-10k Hz

r = distance from the source, in this case 100 m.

~~5.5.4~~6 Merit Parameter Calculation *(1/1/2023)*

For the purposes of these Rules, the merit level X, defined in [1.1.1], is calculated by the following procedure:

a) the noise merit parameter, Cmr, is calculated by linear interpolation as follows:

Cmr = 0 if $L_{A\overline{eq}} > L_{max}$

Cmr = 1 - ($L_{A\overline{eq}}$-L_{min})/(L_{max}-L_{min}) if $L_{min} \le L_{A\overline{eq}} \le L_{max}$

Cmr = 1 if $L_{A\overline{eq}} < L_{min}$

where:

L_{Aeq} : final A-weighted sound pressure level representative of the ship external noise emitted at 100 m

L_{min} : lower bound for the noise level (Tab 1)

L_{max} : upper bound for the noise level (Tab 1)

b) the noise merit level, X, is the noise merit parameter, Cmr, times 100.

Table 1 : External Noise Limits at 100 m *(1/1/2020)*

	L_{min}	L_{max}
	[dB(A)]	[dB(A)]
External Noise Limit at 100 m	45	65

Note 1: External Noise Limits have been calculated based on "Environmental Noise Guidelines for the European Region" developed by World Health Organization in 2018.

67 Reporting example

67.1

67.1.1 *(1/1/2020)*

The test report is to include all the information and data required to verify the fulfilment of the notation.

The minimum set of information is to be agreed with the Society before carrying out the trials.

Results are to be submitted in a report which includes:

- the main characteristics of the ship and of the measurement instrumentation;
- the main characteristics of the port of measurements (satellite image of the port with highlighted ship position is recommended);
- the noise measurements plan;
- a summary table showing, for each measurement carried out, the recorded noise levels and all post processing corrections carried out.

78 Assignment criteria

78.1

78.1.1 *(1/1/2020)*

The additional class notation is assigned to all ships reaching a merit parameter (X) equal or greater than 1.

SECTION 6 DYNAMIC POSITIONING (DYNAPOS)

1 General

1.1 Application

1.1.1 *(1/7/2017)*

The additional class notation **DYNAPOS** is assigned, in accordance with Pt A, Ch 1, Sec 2, [6.14.6], to ships fitted with dynamic positioning installations complying with the requirements of this Section, as follows:

- **DYNAPOS-SAM**
- **DYNAPOS-DP1**
- **DYNAPOS-DP2**
- **DYNAPOS-DP3**

For the purpose of this Section, these notations are indicated using the following abbreviations:

- **SAM** for **DYNAPOS-SAM**
- **DP1** for **DYNAPOS-DP1**
- **DP2** for **DYNAPOS-DP2**
- **DP3** for **DYNAPOS-DP3**

1.1.2 *(1/7/2017)*

SAM (semi-automatic control): the control system of the installation is to be achieved by automatic conversion of the instructions issued by the operator in thruster commands: the operator's manual intervention is necessary for position keeping.

1.1.3 *(1/7/2017)*

DP1 (automatic control): position keeping is automatically achieved and loss of position and/or heading may occur in the event of a single failure.

1.1.4 *(1/7/2017)*

DP2 (automatic control): position keeping is automatically achieved, but loss of position and/or heading is not to occur in the event of a single failure in any active component or system. Single failure criteria include:

- any active component or system (generators, thrusters, switchboards, communication network, remote controlled valves, etc.),
- any static component (cables, pipes, manual valves, fitting, junction, etc.) not properly protected from external damage. Static components will not be considered to fail where adequate protection from damage is demonstrated to the satisfaction of the Society.

1.1.5 *(1/1/2021)*

DP3 (automatic control): position keeping is automatically achieved, but loss of position and/or heading is not to occur in case of a single failure. Single failure criteria include:

- any active component or system (generators, thrusters, switchboards, communication network, remote controlled valves, etc.),
- any static component,
- all components in any one watertight compartment and any one fire sub-division, due to fire or flooding.

Note 1: It is assumed that all active and static components are subjected to proper maintenance.

1.1.6 *(1/1/2021)*

The additional class notation **DP PLUS** is assigned, in accordance with Pt A, Ch 1, Sec 2, [6.14.6], to ships having the additional class notation **DYNAPOS-DP2** or **DYNAPOS-DP3** and equipped with a dynamic positioning (DP) system complying with the requirements specified in [11]. An additional FMEA is needed to demonstrate the compliance with the requirements listed in [11].

1.1.7 *(1/7/2017)*

For **DP2** and **DP3**, a single inadvertent act is to be considered as a single failure if such an act is reasonably likely.

1.1.8 *(1/7/2019)*

Based on the single failure criteria in [1.1.4] and [1.1.5], the worst case failure is to be determined and used as the criterion for the consequence analysis.

1.1.9 *(1/7/2017)*

The notations may be completed by the feature **SKC (L, I1, I2, I3, I4)**, defined in [10].

1.1.10 *(1/7/2017)*

These requirements are additional to those applicable in other parts of the Rules.

1.1.11 *(1/7/2017)*

These Rules do not cover the association of the dynamic positioning system to a position mooring system. However, if a position mooring system is used to assist the main dynamic positioning system in special circumstances of operation, this system is to be at least designed in such a way to control the length and tension of individual anchor lines remotely. An analysis of the consequences of anchor line breaks or thruster failure, according to the operational mode of the installation, is to be carried out.

1.2 Definitions

1.2.1 Alarm devices: visual and audible signals enabling the operator to immediately identify any failure of the dynamic positioning system.

10.4 Site specific environmental conditions

10.4.1 *(1/7/2017)*

The indices of the feature SKC are to be defined based on the limiting wind speed, as specified in [10.1.3].

10.4.2 *(1/7/2017)*

The combination of wind speed, wave height, wave period and current speed, as well as the wave spectrum and spreading function considered for the analysis are to be relevant for the location analysed. Wind, waves and current can be not collinear. Each SKC index derives from the most unfavourable combination.

10.4.3 *(1/7/2017)*

If the limiting environmental conditions refer to the North Sea and correlations among wave height, wave period, wind speed, current speed, as well as wave spectrum and spreading function are derived from IMCA M 140.

10.5 Assessment of the forces

10.5.1 *(1/7/2017)*

Environmental forces (wind, wave drift and current loads), thrust and rudder forces are to be evaluated through tunnel and tank model tests, computational fluid dynamics calculations or other recognised methods.

10.5.2 *(1/7/2017)*

The assessment of the environmental forces over the heading range of interest has to be performed with a minimum resolution of 10°.

11 DP PLUS notation

11.1 Application

11.1.1 *(1/1/2021)*

The main objective of the **DP PLUS** notation is to increase reliability, performance, protection and detection functions of DP systems during the operative profiles of the ship.

11.1.2 *(1/1/2021)*

The functions and features requested to obtain the **DP PLUS** notation are not intended to mitigate the worst case failure defined for a ship having the **DYNAPOS** notation

11.1.3 *(1/1/2021)*

The **DP Plus notation** may be assigned as follows, depending on different functions and operating capability of the DP system:

- **DP PLUS-DFS**
- **DP PLUS-FFP**
- **DP PLUS-PRD**

11.1.4 *(1/1/2021)*

The **DP PLUS** notation may allow different operative modes of DP system during the DP operation of the ship, provided that these operative modes are addressed in the risk assessment.

11.1.5 *(1/1/2021)*

Any limitations resulted by the risk assessment are to be clearly understood by ship's Master. The features of the **DP PLUS** notation need to be evaluated during DP operation according to the criteria listed in paragraph 4 of IMO circular MSC.1/Circ. 1580.

11.2 General

11.2.1 *(1/1/2021)*

For the purpose of this Section, the following abbreviations are used to indicate the notations listed in [11.1.3]:

- **DFS** for **DP PLUS-DFS**
- **FFP** for **DP PLUS-FFP**
- **PRD** for **DP PLUS-PRD**

11.2.2 *(1/1/2021)*

The **DFS (Dual Feeding System)** notation allows the dual feeding operation of thrusters during DP operations. This notation is assigned when power system of the thrusters complies with the requirements in [11.3] that are beyond those for the **DYNAPOS** notations.

11.2.3 *(1/1/2021)*

The **FFP (Fire and Flooding Protection)** notation enhances fire and flooding tolerance of machinery space of ships having **DP2** class notation; and increases the fire and flooding segregation of machinery space of ships having **DP3** class notation. This notation is assigned when the fire and flooding arrangement and segregation comply with the requirements in [11.4] that are beyond those for the **DYNAPOS** notations.

11.2.4 *(1/1/2021)*

The **PRD (Predictive)** notation allows operative conditions with reduced fuel consumptions due to the following automation capabilities:

- capability of detection and protection of the main switchboard allowing closed bus mode or island mode operations;
- capability of generators and auxiliary systems allowing standby of generators during low risk operating profile.

The low risk operating profile refers to Task Appropriate Mode (TAM) of IMCA Guideline.

This notation is assigned when the power generation system and the power distribution of the main switchboard comply with the requirements in [11.5] that are beyond those for the **DYNAPOS** notations.

11.3 Functional requirements for DFS notation

11.3.1 *(1/1/2021)*

The notation **DFS** can be added to the **DYNAPOS DP2** and **DP3** notations on a case-by-case basis.

11.3.2 *(1/1/2021)*

For **DP2 DFS** notation, dual feeding of thrusters and/or propulsion engines from different redundant systems may be accepted on a case-by-case basis, taking into account the operating profile of the vessel (refers to Task Appropriate Mode (TAM) of relevant IMCA Guideline) and as long as the following conditions are met:

a) any failure in the dual feed system is not to propagate to any redundant system and any failure in each redundant system is not to propagate to dual feed system. In order to mitigate the effects of hidden failures, a minimum of two independent protections for each feeding, both

based on degradation conditions resulted by the FMEA document.

b) A-60 separation is to be provided between each DP zone.

c) Each DP zone is to be autonomous in terms of auxiliary systems.

d) Auxiliaries not installed near the main equipment may be accepted provided that they are installed within the same DP zone.

e) Each DP zone may be constituted by two or more compartments. Compartments may be not contiguous or within the same A-60 boundaries.

f) Cables or pipes cross-connection between different DP zone is not allowed, unless connections between the compartments of the same DP zones are needed for their operation.

g) Cables or pipe passages between compartments of different DP zones are to be provided of cable ducts of A-60 class.

h) Cables or pipe passages between compartments of the same DP zones through a common zone are to be provided of mechanical protection.

i) Common zones crossed by cables of different DP zones are to be protected by ducts A-60 class.

j) Equipment and their auxiliaries are to be arranged and designed to satisfy the following criteria:

- a fire is not to cause the loss of generators of two DP zones,
- a fire is not to cause the loss of main switchboard's sections belong to two DP zones,
- a fire is not to cause the loss of propulsion thrusters fed by healthy zones,
- in no case a fire event is to exceed the worst-case failure defined defined for a ship having the **DYNAPOS** notation.

k) Watertight bulkhead separation is to be in place below the damage waterline for machinery spaces.

l) Each DP zone is to have its own service tanks and it is to be located in individual compartments separated by A-60 partitions and be watertight if below the damage waterline.

m) Each switchboard serving a different DP zone is to be located in individual compartments separated by at least A-0 partitions and be watertight if below the damage waterline.

n) Thrusters are to be located in separate watertight compartments with at least A-0 boundaries.

11.5 Functional requirements for PRD notation

11.5.1 *(1/1/2021)*

The notation **PRD** can be added to the **DYNAPOS DP2** and **DP3** notations on a case-by-case basis.

11.5.2 *(1/1/2021)*

For closed bus mode or island mode operation the following conditions are to be met:

a) The main switchboard is to be divisible in four or more sections, able to operate in different configurations. Different sections configurations will be evaluated on the case by case basis, provide that it is demonstrated the fail-safe equivalence to the above requirements.

b) Each section of the main switchboard is to be defined as a redundancy feeding section on the basis of the failure conditions considered in the FMEA document.

c) Based on the design of the main switchboard and relevant control system the redundancy feeding zones may be operated mainly in three modes:

- Island mode. The redundancy feeding sections are disconnected from each other and operate independently.
- Open bus-tie mode. The redundancy feeding zones are coupled to form two sections separated of the main switchboard equally distributed.
- Closed bus-tie mode. The redundancy feeding sections are closed together as a single bus.

d) Closed bus tie mode may include also the closed loop mode. This last mode refers to redundancy feeding Zones that may be closed in loop configuration directly by the bus-tie breakers or by section-link. To such purpose section-link means part of busbar between two continuous breakers without derived circuits.

e) Each redundancy feeding section is to be autonomous in term of its auxiliaries, control and automation.

f) Common cause failure is to be avoided. Where unavoidable it is to be demonstrated the fail-to-safe principle of the system.

g) Arrangement of the redundancy feeding sections is to satisfy the criteria of DP class assigned and the notation **FFP** if assigned.

h) The design of the main switchboard control system (and automation) is to be such that a single failure does not exceed the worst-case failure defined for a ship having the **DYNAPOS** notation.

i) Each section of the main switchboard is to be provided of an approved bus-tie breaker on each end side, able to be operated manually and remotely.

j) Bus-tie breakers are to be arranged such that a failure of one bus-tie breaker does not result in a total blackout.

k) The arrangement of bus-tie breakers is to be in compliance with the criteria of **DP** class assigned and the notation FFP if assigned.

l) This safety and alarm system is to be able to activate a software based safety and alarm systems are to satisfy the visual and audible alarm in a manned control sta-

tion and activate safety functions on the switchboard to iso- late the faulty section.

m) This system is to be manually excludable and self-checking type, any abnormal condition is to activate a visual and audible alarm.

n) Any abnormal condition or failure to the safety and alarm system is not to cause unsafe conditions of the main switchboard.

11.5.3 *(1/1/2021)*

Safety and alarm systems developed on software base are to satisfy the requirements listed in Pt C, Ch 3, Sec 3.

11.5.4 *(1/1/2021)*

Hardware devices needed for operation of the system are to be Type Approved.

11.5.5 *(1/1/2021)*

The network communication system is to be designed to eliminate any hidden failure. The fail to safe condition is to be verified at least in case of: open circuit, short-circuit, power failure, data storm, bus error, timing error, data inconsistency.

11.5.6 *(1/1/2021)*

Any fault in one section of the main switchboard is not to propagate to other sections.

11.5.7 *(1/1/2021)*

Any fault of the safety and alarm system is not to prevent the operation of the main switchboard in open bus-tie mode and island mode.

11.5.8 *(1/1/2021)*

Any fault of the safety and alarm system is not to prevent the local and manual operation of the main switchboard.

11.5.9 *(1/1/2021)*

A fail-to-safe condition is to be defined for each operating mode and documented through the FMEA analysis. The fail to safe conditions is to be demonstrated by the RINA Surveyor.

11.5.10 *(1/1/2021)*

Main switchboard and its auxiliaries are to be arranged and designed not to exceed the worst-case failure defined for a ship having the **DYNAPOS** notation.

11.5.11 *(1/1/2021)*

Main switchboard and its auxiliaries are to be suitably arranged to satisfy the criteria of advanced fire and flooding notation if assigned.

11.5.12 *(1/1/2021)*

The ship is to be capable to maintain the position and/or heading in intact conditions with a redundancy feeding section faulty or fault of an associated generators and thrusters. Reliability of each redundancy feeding section and segregation of each DP zone is to be demonstrated on board.

11.5.13 *(1/1/2023)*

For standby system of generators, the following conditions are to be met:

a) Each diesel generator is to be provided of a safety and alarm system (here after called Advanced Generator System, AGS) capable to detect abnormal conditions during the operation of each generator.

b) The Advanced Generator System is to be capable to detect and alarm at least the following anomalies included but not limited to:

- Excess and insufficient fuel
- Over and under-excitation
- Generator instability or hunting
- Loss of exciter current
- Active and reactive power sharing imbalance

c) The AGS is to be able to activate a visual and audible alarm in a manned control station and activate safety functions (stopping and/or disconnecting) the respective diesel generator.

d) This system is to be manually excludable and self-checking type, any abnormal condition is to activate a visual and audible alarm.

e) Any abnormal condition or failure to the safety and alarm system is not to cause unsafe conditions of the generator.

f) Any fault to the AGS is not to stop any running generator and prevent the operation of generators in stand-by.

g) Any fault of the safety and alarm system is not to prevent the local and manual operation of the diesel generator.

h) A fail-to-safe condition is to be defined and documented through the FMEA analysis. The fail to safe conditions is to be demonstrated by RINA Surveyor.

i) Main switchboard and its auxiliaries are to be arranged and designed to not exceed the worst case failure defined for a ship having the **DYNAPOS** notation.

j) Main switchboard and its auxiliaries are to be suitably arranged to satisfy the criteria of advanced fire and flooding notation if assigned.

k) Auxiliary equipment needs for the starting and operation of the diesel generator are to be duplicated and suitably arranged to satisfy the criteria of advanced fire and flooding notation if assigned.

l) Auxiliary equipment mechanically driven not need to be duplicated.

m) Hydraulic-mechanical type governor does not need to be duplicated.

n) All active components necessary to manage the auxiliaries of each redundancy feeding section are to be Type Approved.

o) The standby generator is to be able to start and supply power within ~~20~~45 seconds.

p) Single automatic voltage regulator may be accepted if provided of two mirrored control systems (master and slave type).

q) Duplicated auxiliary equipment are to be provided of self-checking system as appropriate. Any abnormal condition is to be alarmed and activate the automatic change-over with the standby equipment.

r) Auxiliary equipment may be dedicated to group of diesel generator (e.g. sea water cooling system) based on

SECTION 24 ~~GAS~~LNG READY (X1, X2, X3…) AND CNG READY (X1, X2, X3…)

1 General

1.1 Application

1.1.1 *(1/1/2023)*

The additional class notation ~~GAS~~LNG **READY (X1, X2, X3…)** or **CNG READY (X1, X2, X3…)** is assigned, in accordance with Pt A, Ch 1, Sec 2, [6.14.37]), to ships fulfilling the requirements of this section.

A Certificate of Compliance may be issued to ships not classed with the Society, fulfilling the requirements of this section.

2 Assignment criteria

2.1

2.1.1 *(1/1/2023)*

The additional class notation ~~GAS~~LNG **READY (X1, X2, X3 …)** or **CNG READY (X1, X2, X3 …)** is assigned:

a) to new buildings, other than LNG carriers, that are in accordance with the RINA Rules in force at the date when the contract for construction between the Owner and the shipbuilder is signed;

b) to existing ships, other than LNG carriers, that are in accordance with the RINA Rules in force at the date of request of notation assignment.

having the following characteristics:

- Design (X1); and
- One of the following:
  - Structure (X2);
  - Tank (X3);
  - Piping (X4);
  - Users (X5).

The notation characteristics **(X1, X2, X3…)** are defined in Tab 1.

Irrespective of previous assignment of the ~~GAS~~LNG **READY or CNG READY** notation, when the ship will be converted in gas fuelled ship, approval for compliance with the Statutory and RINA requirements in force at the time of conversion, followed by testing and commissioning under survey, will be required.

Table 1 : Description of the notation characteristics *(1/1/2023)*

X_i	Characteristic	Description
1	Design	The complete design of the ship with gas fuelled system is found to be in compliance with the rules applicable to new buildings, including those for the ~~GAS~~LNG **FUELLED or CNG FUELLED** notation (ref. Pt C, Ch 1, App 7)
2	Structure	Structural reinforcements to support the fuel containment system (LNG fuel tank(s)) are installed and materials to support the relevant temperatures are used.
3	Tank	Gas storage tank, tank master isolation valve, fuel venting arrangements and, where applicable, the fuel storage hold space, structural fire protection and ventilation arrangements for under deck tank locations are built under survey and installed in accordance with approved drawings and certified fit for gas fuel operations.
4	Piping	All piping equipment associated with the gas fuelled system, e.g. pipes, pumps, valves, etc. including all bunkering arrangements and associated access arrangements including structural fire protection as applicable, are built and installed in accordance with approved drawings and certified fit for gas fuel operations

X_i	Characteristic	Description
5	Users	Engineering systems are installed in accordance with approved drawings and certified fit for using gas as fuel or ready to be retrofitted: • ME_{rr}: Main engine(s) installed can be converted to dual fuel engines; • ME_{df}: Main engine(s) installed are dual fuel engines; • AE_{rr}: Auxiliary engines installed can be converted to dual fuel engines (see Note 1); • AE_{df}: Auxiliary engines installed are dual fuel engines (see Note 1); • B_{rr}: Boilers installed can be converted to dual fuel; • B_{df}: Boilers installed can be operated on gas fuel.
Note 1: The capacity of the converted auxiliary engines is to be sufficient for the ship power balance. Examples: • ~~GAS~~LNG READY (Design, Users(ME_{rr})) means that the future LNG fuelled design has been examined and found in compliance with the applicable rules and the ship main engine is of a type that can be converted to dual fuel engine; • ~~GAS~~LNG READY (Design, Structure, Users(ME_{rr}, AE_{rr})) means that the future LNG fuelled design has been examined and found in compliance with the applicable rules, the ship is constructed with the necessary structural reinforcement and low temperature materials around the LNG fuel tank(s), and the main and auxiliary engines are of types that can be converted to dual fuel engines.		

3 Documents to be submitted

3.1 Documentation requirements for characteristic "Design"

3.1.1 *(1/1/2023)*

The list of plans and documents to be submitted is given in Tab 2.

The documentation is to be marked "~~Gas~~LNG ready" or "CNG ready" in each drawing title.

The Society reserves the right to require additional documents in the case of non-conventional design or if it is deemed necessary for the evaluation of the systems and components.

3.2 Documentation requirements for characteristics "Structure", "Tank", "Piping", "Users"

3.2.1 *(1/10/2015)*

The design, applicable to the assigned characteristic, is to be submitted and approved for compliance with the applicable sections of Pt C, Ch 1, App 7.

Table 2 : Documents to be submitted *(1/10/2015)*

Item n°	Documentation	Additional description
1	General arrangement	Including LNG tank location with distances from ship side, adjacent spaces, bunkering station location, pipe routing, engine room arrangement and location of any other spaces containing gas equipment. Location of entrances (air locks as relevant) for spaces with gas equipment are also to be shown.
2	Engine room arrangement	Only if not included in the general arrangement.
3	Design philosophy/ description	Including information on the machinery configuration, engine room arrangements, fuel arrangements, shut down philosophy, redundancy considerations etc.
4	Hazardous zones drawing	General arrangement plan with the indication of the hazardous area classification
5	Ventilation system	For gas equipment spaces, including ventilation capacity, location of inlets and outlets, segregation from other ventilation systems.
6	Tank arrangement drawing	Including arrangement of tank connection space and pump rooms/compressor rooms where relevant. The LNG tank design drawings are preferably to contain sufficient detail to allow for structural strength and thermal exposure calculations for surrounding structure.
7	Structural strength calculation for the LNG fuel tank location	
8	Temperature calculations around the LNG fuel tanks	
9	P&ID for LNG bunkering and gas fuel systems	Including details for double piping/ducts and arrangement/ location of vent mast/vent outlet(s) for pressure relief valves and purging.

SECTION 30 DIGITAL SHIP (ADC)

1 General

1.1 Application

1.1.1 *(1/1/2023)*

The additional class notation **DIGITAL SHIP (ADC)** is assigned to ships complying with the requirements of this section. In particular, it is assigned to ships fitted with an automatic data collection system enabling the collection of navigation and machinery data and capable of transferring data (either as collected or after the necessary elaboration)~~their transmission on~~ ashore, allowing the continuous monitoring of the ship through at least the minimum set of parameters described in this Section.

A Certificate of Compliance may be issued to ships not classed with the Society, fulfilling the requirements of this section.

2 Defintions

2.1

2.1.1 *(1/1/2019)*

- Data Collector is an electronic system that performs a systematic recording of signals from sensors and equipment installed on board and information manually provided.
- Data Point is a complete set of collected and filtered data over a period not greater than 10 minutes.
- Data Storage is the operation of saving and retention of recorded data. Previously stored data are to be kept together with new data, ordered in a sequence so that their retrieval can be easily performed.
- Owner, in this section, means Ship Owner or Ship Management Company.
- Parameter is the variable which value is collected and recorded by the data collector.
- Recorded data is the representative value of the parameter obtained, depending from the nature of the parameter, as a mean value or a single representative value of collected data in a time frame.
- Representative Value is a processed Data Point stored.
- RINACube is RINA's cloud platform to analyse collected data.
- Time stamp is the data reference time expressed in UTC.

3 Documents to be submitted

3.1

3.1.1 *(1/1/2023)*

The following documents are to be submitted for information:

- list of bridge collected signals,
- list of machinery collected signals,
- list of signals transferred ~~on~~ ashore.

Depending on the ship arrangement and on the data collection system architecture, additional drawings or documents may be required at Society's discretion.

4 Requirements

4.1 General

4.1.1 *(1/1/2019)*

The ship is to be fitted with an automatic data collector capable to transfer data to RINACube.

4.1.2 *(1/1/2023)*

The minimum set of parameters that the data collector is to be capable of collecting, recording and transferring (either as collected or after the necessary elaboration)~~on~~ ashore and/or to RINACube platform is listed in [4.2].

4.2 Data to be collected, recorded and transferred by the data collector

4.2.1 Bridge/navigation data *(1/1/2019)*

- GPS (position, speed over ground, course over ground)
- Gyrocompass (Heading)
- Speed log (speed through water)
- Anemometer (Wind speed and direction, true or relative)
- Loading condition (Draft, Displacement).

4.2.2 Machinery data *(1/1/2019)*

- Shaft(s) RPM
- Shaft(s) power)
- Propeller(s) Pitch (if applicable)
- Main Engine(s) fuel consumption (if applicable, i.e. for diesel propulsion)
- Main Engine(s) status (on/off)
- Shaft(s) generator(s) power (if any)
- Diesel Generator(s) power
- Diesel Generator(s) fuel consumption
- Main Engine(s) fuel type in use (if applicable, i.e. for diesel propulsion)
- Diesel Generator(s) fuel type in use.

4.3 Minimum Data Acquisition Rate

4.3.1 *(1/1/2019)*

Automatic data collection is to be continuous so as to allow the identification of a representative value for a time frame, in accordance with [4.4].

4.4 Recorded Data (Representative Value and Time Stamp)

4.4.1 *(1/1/2019)*

Automatic data collection is to be continuous so as to allow the identification of a representative value for a time frame, in accordance with [4.4].

4.4.2 *(1/1/2019)*

Data Point for each Parameter is to be processed to identify a Representative Value that, along with the reference Time stamp, will be the Recorded data. The time frame between two Representative Values is not to be greater than 10 minutes.

4.5 Storage Requirements

4.5.1 *(1/1/2019)*

All Representative Values are to be stored along with the Time stamps indicating the time when the Representative Value was made.

A back up facility of all stored data is to be foreseen.

Being the data collection system installed on board, the backup facility is to be located elsewhere.

Access to the data is to be logged, controlled and secured by the Owner.

4.6 RINACube interface

4.6.1 *(1/1/2023)*

The automatic data collection system is to be capable of submitting the collected data to the RINA's cloud platform RINACube or, alternatively, to an Owner's cloud. Collected data submitted to RINACube will be accessible to the Owner only.

In both cases, the collected data are to be made available to RINA for the time necessary to perform the assessment and verifications needed to maintain the **DIGITAL SHIP** **(ADC)** class notation.

5 General

5.1 Application

5.1.1 *(1/1/2019)*

In case of ship not classified by the Society or upon Owner's request, a certificate of compliance to the requirements of this section may be issued.

The certificate is valid for a period of 5 years, subject to annual confirmation.

SECTION 34 REMOTE

1 General

1.1 Application

1.1.1 *(1/1/2023)*

The additional class notation **REMOTE** is assigned, in accordance with Pt A, Ch 1, Sec 2, [6.14.50], to ships:

- ~~deemed eligible by the Society, at its sole discretion, to have class surveys carried out remotely, including periodical surveys, considering their age, service and records of maintenance and operation;~~
- provided with specific arrangements and qualified personnel on board in order to facilitate the Society to carry out remotely the eligible class surveys in Ch 2, App 5, Tab 1~~remotely~~;
- provided with electronic certificates.

~~The Society bases its own exclusive evaluation on several key elements including but not limited to the ship's age, service, class records, the ship's and Company's performance against PSC and flag State inspections.~~

The Society reserves the right, at its sole discretion, to either suspend or withdraw the Additional Class Notation in case of ~~the above-mentioned evaluation is no longer valid, e.g. due to a~~ worsening of the ship's condition of maintenance or PSC performance, or change of Management Company, unavailability of the specific arrangements and certified personnel on board.

1.1.2 ~~*(5/6/2020)*~~

~~As far as statutory survey items are concerned, the ship's Flag Administration requirements on remote surveys are to be complied with.~~

1.2 Definitions

1.2.1 *(1/1/2023)*

- Remote Survey: a process of verifying that a ship and its equipment are in compliance with the Rules where the verification is undertaken, or partially undertaken,~~a survey carried out by the Society~~ without ~~physical~~ attendance of the Surveyor on board~~, based upon appropriate digital evidence (videos, pictures, documents) taken in livestreaming and/or offline and gathered to demonstrate continuing compliance with the Rules~~.

  Note 1: Remote classification activities not requiring a survey, such as some administrative tasks, are not to be considered as remote surveys.

- Connectivity Kit: an electronic system which allows livestreaming videos to be taken in enclosed spaces (e.g. engine room, tanks, etc.) where internet connection is not available, as detailed in [2].

2 Requirements

2.1 Devices for livestreaming

2.1.1 *(5/6/2020)*

A portable device (smartphone, tablet, etc.) provided with wide angle functionality and high-quality optical lenses is to be available on board.

Closed type headphones with microphone, for proper communication during livestreaming, are also requested.

2.2 Connectivity Kit

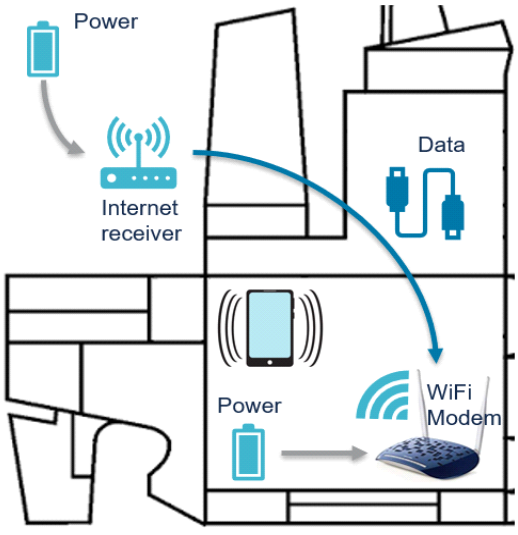
2.2.1 *(5/6/2020)*

The ship is to be provided with a Connectivity Kit (see Fig 1) enabling the ship to have internet access also in enclosed spaces (ballast tanks, engine room, etc.).

The kit shall be composed of:

- an internet receiver, equipped with a sim card for data transfer
- a Wi-Fi modem
- a network cable of sufficient length to connect the two a.m. devices
- power packs to make the devices independent from the ship's electrical power supply.

Figure 1 *(5/6/2020)*



2.3 Hazardous areas

2.3.1 *(1/1/2023)*

In hazardous areas, all devices used, under the responsibility of the Master, for livestreaming or offline recordings and the Connectivity Kit are to be of an appropriately certified safe type.

2.4 Training, qualification and certification of on-board personnel

2.4.1 *(1/1/2023)*

The on-board personnel (ship's crew members) who take an active part in the remote survey and manage the devices for live streaming to take videos and pictures (even if offline) and the Connectivity Kit ~~for enclosed spaces~~ are to be in possession of the Certificate of Competency issued by the Society upon satisfactory completion of the specific e-learning course made available by the Society and aimed at providing the necessary operational information and skills.

2.5 Electronic certificates

2.5.1 *(5/6/2020)*

The class and statutory certificates issued to the ship by the Society are to be in electronic form.

3 Assignment of the additional class notation

3.1

3.1.1 *(5/6/2020)*

The additional class notation **REMOTE** is assigned upon:

- satisfactory evaluation by the Society of the requirements in [1.1] being complied with; and
- satisfactory verification on board by a Society's Surveyor of the requirements from [2.1] to [2.5] being complied with.

SECTION 36 SUSTAINABLE SHIP

1 General

1.1 Application

1.1.1 *(1/1/2023)*

The additional class notation **SUSTAINABLE SHIP** is assigned, in accordance with Pt A, Ch 1, Sec 2, [6.14.54], to ships complying with the criteria in [5], having regard to:

a) design and provision of systems, components and procedural means to control and prevent the emission of polluting substances into the sea, the air and, more in general, the environment (reference is made to **GREEN PLUS** additional class notation)

b) underwater noise limitation (reference is made to **DOLPHIN** additional class notations)

c) noise and vibration limitation on board (reference is made to **COMF-NOISE** and **COMF-VIB** additional class notations)

d) compliance with ~~**COMF-**~~**NOISE-PORT-OUT(X)** or **NOISE-PORT-IN(X)** additional class notations

e) compliance with **MLCDESIGN** additional class notation

f) compliance with **BIOSAFE SHIP** additional class notation

g) achievement of EEDI and EEXI values 40% lower than those in Phase 0 EEDI reference lines (see Note 1) in MARPOL Annex VI, according to the 2030 target in Initial IMO strategy on reduction of GHG emissions from ships (Res. MEPC.304(72)).

Note 1: For ro-ro cargo ships and ro-ro passenger ships, reference is made to Phase 2 EEDI reference lines.

A Certificate of Compliance may be issued to ships not classed with the Society, fulfilling the requirements of this section.

2 Definitions

2.1

2.1.1 *(1/1/2023)*

Definitions are those given in:

- Ch 6, Sec 1 (**COMF-NOISE** additional class notation)
- Ch 6, Sec 2 (**COMF-VIB** additional class notation)
- Ch 6, Sec 4 (~~**COMF-**~~**NOISE-PORT-OUT(X)** and **NOISE-PORT-IN(X)** additional class notations)
- Ch 7, Sec 1 (**GREEN PLUS** additional class notation)
- Sec 13 (**MLCDESIGN** additional class notation)
- Sec 25 (**DOLPHIN** additional class notations)
- Sec 33 (**BIOSAFE SHIP** additional class notation)
- MARPOL Annex VI.

3 Documents to be submitted

3.1

3.1.1 *(1/1/2023)*

The list of plans and documents to be submitted is given in the relevant paragraphs of:

- Ch 6, Sec 1 (**COMF-NOISE** additional class notation)
- Ch 6, Sec 2 (**COMF-VIB** additional class notation)
- Ch 6, Sec 4 (~~**COMF-**~~**NOISE-PORT-OUT(X)** and **NOISE-PORT-IN(X)** additional class notations)
- Ch 7, Sec 1 (**GREEN PLUS** additional class notation)
- Sec 13 (**MLCDESIGN** additional class notation)
- Sec 25 (**DOLPHIN** additional class notations)
- Sec 33 (**BIOSAFE SHIP** additional class notation).

The Society reserves the right to request the submission of additional documents in the case of non-conventional design or when it is deemed necessary for the evaluation of the systems and components.

4 Sustainable index calculation

4.1

4.1.1 *(1/7/2021)*

The sustainable index is obtained by adding up the values of the contributions for each criteria the ship complies with, according to Tab 1.

5 Assignment criteria

5.1

5.1.1 *(1/7/2021)*

The compliance with the requirements for the assignment of **MLCDESIGN** and **BIOSAFE SHIP** additional class notations is a prerequisite for the assignment of **SUSTAINABLE SHIP** additional class notation.

5.1.2 *(1/1/2023)*

The **SUSTAINABLE SHIP** notation is assigned to ships complying with the minimum requirements for assignment specified in Tab 1. The relevant sustainable index is calculated in accordance with [4].

Examples:

- A ship in full compliance with the requirements of **GREEN PLUS**, **DOLPHIN**, **COMF-NOISE**, **COMF-VIB**, ~~**COMF-**~~**NOISE-PORT-OUT(X)**, or **NOISE-PORT-IN(X)**, **MLCDESIGN**, **BIOSAFE SHIP** additional class notations and having an EEXI value 40% lower than those in EEDI

reference lines in MARPOL Annex VI is a **SUSTAINABLE SHIP** with sustainable index 100.

- A ship, having an environmental index, as defined in the **GREEN PLUS** requirements, equal to 63; a documented compliance to the contractual ship specification regarding noise or vibration levels; full compliance with the requirements of **MLCDESIGN** and **BIOSAFE SHIP** additional class notations, is a **SUSTAINABLE SHIP** with sustainable index 20.

Table 1 : Criteria for the assignment of SUSTAINABLE SHIP *(1/1/2023)*

		Minimum requirements for assignment	Sustainable index
a) design and provision of systems, components and procedural means to control and prevent the emission of polluting substances into the sea, the air and, more in general, the environment (reference is made to **GREEN PLUS** additional class notation)	60 < E.I. ≤ 80 **(1)**	X	5
	80 < E.I. ≤ 100 **(1)**		10
	E.I. > 100**(1)**		20
b) underwater noise limitation (reference is made to **DOLPHIN** additional class notations)			20
c) ensuring comfort having regard to noise and vibration on board	Documented compliance regarding **noise or vibration** measurements with the contractual ship specification	X	5
	Documented compliance regarding **noise and vibration** measurements with the contractual ship specification		10
	Compliance with **COMF-NOISE** additional class notation		10
	Compliance with **COMF-VIB** additional class notation		10
d) compliance with ~~**COMF-**~~**NOISE-PORT**-**OUT**(X) **or NOISE-PORT-IN(X)** additional class notations			10
e) compliance with **MLCDESIGN** additional class notation		X	5
f) compliance with **BIOSAFE SHIP** additional class notation		X	5
g) achievement of EEDI and EEXI values 40% lower than those in Phase 0 EEDI reference lines in MARPOL Annex VI **(2)**			20

(1) E.I. is the **GREEN PLUS** Environmental Index

(2) For ro-ro cargo ships and ro-ro passenger ships, reference is made to Phase 2 EEDI reference lines

SECTION 41 CARGO PIPING PROTECTED (CPP)

1 General

1.1 Application

1.1.1 *(1/1/2023)*

The additional class notation **CPP** is assigned, in accordance with Pt A, Ch 1, Sec 2, [6.14.65], to ships having all cargo piping and valve control piping located above the double bottom and complying with the requirements of this Section.

2 Cargo Piping - Pollution Prevention Measures

2.1 Routing

2.1.1 *(1/1/2023)*

For oil tankers and oil carriers of 5,000 tonnes deadweight and above, cargo piping, including cargo tank vent and sounding pipes, is not to pass through ballast tanks. Short runs of such pipes may be permitted provided they have all joints welded and are of wall thickness not less than that in Pt C, Ch 1, Sec 10, Tab 5 or equivalent construction. See also Pt E, Ch 7, Sec 4, [2.1.3] and Pt E, Ch 25, Sec 4, [2.1.3] for ballast pipe routing.

2.1.2 *(1/1/2023)*

For vessels less than 5,000 tonnes deadweight, cargo piping passing through ballast tanks is to be steel with a minimum thickness according to Pt C, Ch 1, Sec 10, Tab 5, or equivalent construction. In such cargo piping, all joints are to be welded or have extra heavy flanges; no sliding-type expansion joint is permitted. The number of flanged joints is to be kept to a minimum.

2.1.3 *(1/1/2023)*

Where the ship is assigned with the **CPP** notation, cargo piping and valve control piping installed in pipe tunnel or duct keel are also to be located above the double bottom.

2.2 Stripping and small diameter lines

2.2.1 *(1/1/2023)*

For crude oil carriers of 20,000 tonnes deadweight and above and product carriers of 30,000 tonnes and above, means are to be provided to drain all cargo tanks and all oil lines at completion of cargo discharge, where necessary by connection to a stripping device. The line and pump drainings are to be capable of being discharged either ashore and to a cargo tank or a slop tank. For discharge ashore a special small diameter line is to be provided and is to be connected to the vessel's deck discharge manifold outboard of the manifold valves on both sides of the vessel. The cross-sectional area of the small diameter line is not to exceed 10% of that of the main cargo discharge line.

In order to minimize the possibility of flammable vapors being admitted to the cargo pump room, vents from drain tanks serving automatic stripping systems are to terminate in the weather and be fitted with corrosion resistant flame-screens or pressure/vacuum relief valves. Alternatively, the vents may be led to the slop tank.

2.3 Sea chests

2.3.1 *(1/1/2023)*

Where it is necessary to provide a sea connection to the cargo oil pumps to enable ballasting of cargo tanks during severe weather conditions, tank cleaning, etc., a means of isolating the pumps from the sea chests when they are not being used for this operation is to be provided. This is to be achieved by a blank flange or a removable spool piece. The spool piece, if used, is to be stowed as in [2.4] below. A shut-off valve is to be fitted on each side of the blank flange or the removable spool piece.

Alternatively, two valves are to be installed at the sea chest connection. One of these valves is to be capable of being locked in closed position and means - such as a test cock - is to be provided for detecting leakage past these valves.

2.4 Connection to ballast system

2.4.1 *(1/1/2023)*

Connection of the cargo system to the ballast system is only permitted by a removable spool piece in an emergency. The arrangements of the spool piece are to include:

- a non-return valve to prevent cargo from entering the ballast system, and
- shut-off valves and blind flanges on both the ballast end and the cargo end of the connection.

The spool piece is to be stowed in a conspicuous manner so that it may be readily available whenever the need arises. A permanent notice is to be displayed to prohibit unauthorized use of spool piece.

2.5 Crude oil washing system

2.5.1 *(1/1/2023)*

For crude oil carriers of 20,000 tonnes deadweight and above, the crude oil washing system is to comply with MARPOL 73/78, Annex I, Reg. 33 and IMO Resolution A.446(XI) "Revised specifications for the design, operation and control of crude oil washing systems", as amended by Resolutions A.497(XII) and A.897(21).

Where a crude oil washing system is fitted on a vessel of less than these deadweight sizes, only requirements concerning safety need be complied with.

The crude oil washing system is to be operated only when the cargo tank is inerted with an inert gas system complying with Pt C, Ch 4.

2.6 Slop tanks

2.6.1 *(1/1/2023)*

For oil tankers and oil carriers of 150 gross tonnage and above, slop tanks of number and sizes complying with Pt E, Ch 7, Sec 4, [5.2] and Pt E, Ch 25, Sec 4, [5.2] and MARPOL 73/78, Annex I, Reg. 29 are to be provided to receive dirty ballast residues, tank washings and other oil residues.

Slop tanks are to be so designed in respect of the position of inlets, outlets, baffles or weirs where fitted, so as to avoid excessive turbulence and entrainment of oil or emulsion with water.

SECTION 42 PERSONNEL LIFTING

1 General

1.1 Application

1.1.1 *(1/1/2023)*

The additional class notation **PERSONNEL LIFTING** may be assigned, in accordance with Pt A, Ch 1, Sec 2, [6.14.30], to units having installed on board a crane or lifting arrangements intended to be used for personnel lifting which complies with the requirements in [2].

2 Requirements

2.1 General

2.1.1 *(1/1/2023)*

For the assignment of the additional class notation **PERSONNEL LIFTING**, the crane or lifting arrangements intended to be used for personnel lifting is to comply with the requirements in the "Rules for loading and unloading arrangements and for other lifting appliances on board ships or other similar units".

2.1.2 *(1/1/2023)*

The additional class notation **PERSONNEL LIFTING+** may be assigned when the crane is also fitted with an emergency recovery system which permits through its own independent means to control slew, luff down, and lowering operations in the event of a single failure in the power or control system. Such means is to provide controlled slewing of the crane and lowering and stopping of the winch drums and cylinders under all load conditions.

2.1.3 *(1/1/2023)*

The additional class notation **PERSONNEL LIFTING++** may be assigned when the crane is also fitted with an emergency recovery system which permits through its own independent means for perform all main functions, such as slewing, luffing up and down, hoisting up and down, folding and unfolding, telescoping in and out, etc., in the event of a single failure in the power or control system, under all load conditions.

2.2 Emergency recovery system requirements

2.2.1 *(1/1/2023)*

For the emergency recovery systems mentioned in [2.1.2] and [2.1.3], the following apply:

a) Components that are used only for transfer of power or signals from the power unit to the actuators (motors, cylinders, etc.), such as pipes, flexible hoses and electric cables, need not to be taken into consideration in the single failure of the power and control system.

b) When the crane is fitted with a secondary power and/or independent control system, the manual activation switches or handles for the emergency operation system shall be of a "hold to run type" and clearly and permanently marked for their purpose.

c) When means for lowering are based on gravitational forces, the minimum load to enable lowering of the hook is to be determined by the manufacturer and included in the personnel lifting crane capacity rating chart.

d) Operational instructions for the emergency recovery system are to be distinctly posted at the operator's station.

SECTION 43 COATING PERFORMANCE STANDARD IN CARGO OIL TANKS (CPS-COT)

1 General

1.1 Application

1.1.1 *(1/1/2023)*

The additional class notation **CPS-COT** is assigned, in accordance with Pt A, Ch 1, Sec 2, [6.14.66], to crude oil tankers of new construction with cargo oil tanks provided with protective coatings complying with the requirements of this Section.

The additional class notation **CPS-COT** indicates that a crude oil tanker meets the Performance Standard for Protective Coatings for Cargo Oil Tanks of Crude Oil Tankers in IMO Resolution MSC.288(87).

1.1.2 *(1/1/2023)*

The criteria for the selection, application and maintenance of protective coatings in cargo oil tanks provided in this Section, are based on the following international requirements:

a) IMO Resolution MSC.288(87), Performance Standard for Protective Coatings for Cargo Oil Tanks of Crude Oil Tankers (IMO PSPC-COT).

b) IACS UI SC259, Unified Interpretations for Application of SOLAS Regulation II-1/3-11 Performance Standard for Protective Coatings for Cargo Oil Tanks of Crude Oil Tankers (PSPC-COT), adopted by IMO Resolution MSC.288(87).

c) IACS UR Z17, IACS Procedural Requirements for Service Suppliers.

A different "coating performance standard", which may have been chosen in the agreement between the shipyard and the Owner, may be accepted as a reference standard provided that the Society deems it at least equivalent to the above-mentioned standard.

The reference "coating performance standard" is to be appended as an enclosure to the Certificate of Classification of those ships to which the notation is assigned.

1.1.3 *(1/1/2023)*

The assignment of the notation **CPS-COT** is subject to the verification of the "main work phases" indicated in Sec 12, Tab 1, schedule A) by means of the "survey activities" identified at the milestones indicated in Sec 12, Tab 1, schedule B), as described in Sec 12, [3].

1.2 Definitions

1.2.1 *(1/1/2023)*

Unless otherwise specified, the definitions used in this Section are those in Sec 12, [1.2].

For the purpose of this Section, crude oil tanker is defined as in Annex I of MARPOL 73/78.

2 Coating selection and specification

2.1 General principles

2.1.1 *(1/1/2023)*

The ability of the coating system to reach its target useful life depends on the selected type of coating system, steel preparation, application and coating inspection and maintenance. All these aspects contribute to the good performance of the coating system.

2.1.2 *(1/1/2023)*

Inspections of surface preparation and coating processes are to be agreed upon between the Owner, the shipyard and the coating Manufacturer and submitted to the Society for review, prior to the commencement of the shipbuilding process, in order to check that it complies with the basic coating system requirements shown in Tab 1.

Clear evidence of these inspections is to be reported and be included in the Coating Technical File (see [2.2]).

2.1.3 *(1/1/2023)*

The following aspects are to be taken into account for achieving the required coating performance:

a) it is essential that the agreed technical specifications, procedures and various different steps in the coating application process (including but not limited to surface preparation) are strictly followed by the shipbuilder, in order to prevent premature decay and/or deterioration of the coating system;

b) the effectiveness of these Rule requirements can be improved by adopting measures at the ship design stage such as reducing scallops, using rolled profiles, avoiding complex geometric configurations and ensuring that the structural configuration permits easy access for tools and to facilitate cleaning, drainage and drying of the space to be coated;

c) these Rule requirements are based on experience from Manufacturers, shipyards and ship operators and are not intended to exclude suitable alternative systems or innovative approaches that might be developed and applied in the future, provided that they demonstrate a level of performance at least equivalent to that specified in this Section. Acceptance criteria for alternative systems are given in [2.8].

2.1.4 *(1/1/2023)*

The class notation **CPS-COT** is not intended to be and shall not amount to a warranty of good performance of the coating nor does it replace the contractor warranty granted by the shipyard and/or paint Manufacturer or Supplier.

2.2 Coating Technical File

2.2.1 *(1/1/2023)*

Specification of the coating system applied to the cargo oil tanks, records of the shipyard's and Owner's coating work, and detailed criteria for coating selection, job specifications, inspection, maintenance and repair are to be documented in the Coating Technical File, which is to be reviewed by the Society.

2.2.2 *(1/1/2023)*

The Coating Technical Files is to contain at least the information required in Sec 12, [2.2].

2.3 Health and safety

2.3.1 *(1/1/2023)*

The shipyard is responsible for implementation of national regulations to ensure the health and safety of individuals and to minimise the risk of fire and explosion.

2.4 Coating Standard

2.4.1 Performance Standard *(1/1/2023)*

This coating performance standard is based on specifications and requirements which intend to provide a target useful life of 15 years, which is considered to be the time period, from initial application, over which the coating system is intended to remain in "GOOD" condition. The actual useful life will vary, depending on numerous variables including actual conditions encountered in service.

2.4.2 Area of application *(1/1/2023)*

The following areas are the minimum areas that shall be protected according to this coating performance standard:

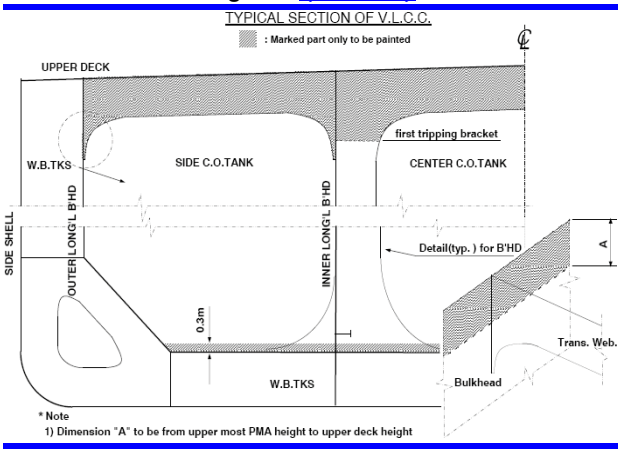
a) deckhead with complete internal structure, including brackets connecting to longitudinal and transverse bulkheads. In tanks with ring frame girder construction the underdeck transverse framing to be coated down to level of the first tripping bracket below the upper faceplate;

b) longitudinal and transverse bulkheads to be coated to the uppermost means of access level. The uppermost means of access and its supporting brackets to be fully coated;

c) on cargo tank bulkheads without an uppermost means of access the coating to extend to 10% of the tanks height at centreline but need not extend more than 3 m down from the deck;

d) Flat inner bottom and all structure to height of 0.3 m above inner bottom to be coated.

Figure 1 *(1/1/2023)*



2.4.3 Special application *(1/1/2023)*

It is recommended that this standard is applied, to the extent practicable, to those portions of means of access provided for inspection within the areas specified in [2.4.2] that are not integral to the ship structure, such as rails, independent platforms, ladders, etc. Other equivalent methods of providing corrosion protection for non-integral items may also be used, provided they do not impair the performance of the coatings of the surrounding structure. Access arrangements that are integral to the ship structure, such as stiffener depths for walkways, stringers, etc., are to fully comply with this Standard when located within the coated areas.

It is also recommended that supports for piping, measuring devices, etc., be coated as a minimum in accordance with the non-integral items indicated in the above paragraph.

2.4.4 Basic coating requirements *(1/1/2023)*

The requirements for protective coating systems to be applied at ship construction for cargo oil tanks meeting the performance standard specified in [2.4.1] are listed in Tab 1.

Coating Manufacturers are to provide a specification of the protective coating system to satisfy the requirements of Tab 1.

The Society will verify the Technical Data Sheet and Statement of Compliance or Type Approval Certificate for the protective coating system.

The shipyard is to apply the protective coating in accordance with the verified Technical Data Sheet and its own verified application procedures.

Table 1 : Basic coating system requirements for the notation CPS-COT *(1/1/2023)*

Item	Requirement	Reference standard
1 - Design of coating system		
a) Selection of the coating system	The selection of the coating system is to be considered by the parties involved with respect to the service conditions and planned maintenance. The following aspects, among other things, shall be considered: a) location of space relative to heated surfaces; b) frequency of cargo operations; c) required surface conditions; d) required surface cleanliness and dryness; e) supplementary cathodic protections, if any (where coating is supplemented by cathodic protection, the coating is to be compatible with the cathodic protection system); f) permeability of the coating and resistance to inert gas and acids; and g) appropriate mechanical properties (flexibility, impact resistance). The Coating Manufacturer is to supply products with documented satisfactory performance records and technical data sheets. The Manufacturer is also to be capable of rendering adequate technical assistance. Performance records, technical data sheets and technical assistance (if given) are to be recorded in the Coating Technical File. Coatings for application underneath sun-heated decks or on bulkheads forming boundaries of heated spaces are to be able to withstand repeated heating and/or cooling without becoming brittle.	
b) Coating type	Epoxy based systems Other coating systems are to have performance according to the test procedure in App 4. A multi-coat system with each coat of contrasting colour is recommended. The top coat is to be of a light colour in order to facilitate in-service inspection. Consideration is to be given to the use of enhanced coatings in way of suction bellmouths and heating coil downcomers. Consideration is to be given to the use of supplementary cathodic protection where there may be galvanic issues.	
c) Coating test	Epoxy-based systems tested prior to the date of entry into force of this Standard in a laboratory by a method corresponding to the test procedure in App 4 or equivalent, which as a minimum meets the requirements for rusting and blistering, or which have documented field exposure for 5 years with a final coating condition of not less than "GOOD", may be accepted. For epoxy-based systems approved on or after entry into force of this Standard, testing according to the procedure in App 4, or equivalent, is required.	

Item	Requirement	Reference standard
d) Job specification	There are to be a minimum of two stripe coats and two spray coats, except that the second stripe coat, by way of welded seams only, may be reduced in scope where it is proven that the NDFT can be met by the coats applied in order to avoid unnecessary over thickness. Any reduction in scope of the second stripe coat is to be fully detailed in the Coating Technical File. Stripe coats are to be applied by brush or roller. A roller is to be used for scallops, ratholes, etc. only. Each main coating layer is to be appropriately cured before application of the next coat, in accordance with the coating Manufacturer's recommendations. Job specifications are to include the dry-to-recoat times and walk-on time given by the manufacturer. Surface contaminants such as rust, grease, dust, salt, oil, etc. are to be removed prior to painting. The method to be according to the paint manufacturer's recommendations. Abrasive inclusions embedded in the coating are to be removed.	
e) NDFT (nominal total dry film thickness)	NDFT 320 µm with 90/10 rule for epoxy based coatings, other systems to the coating Manufacturer's specifications. Maximum total dry film thickness according to Manufacturer's detailed specifications. Care is to be taken to avoid increasing the thickness in an exaggerated way. Wet film thickness is to be regularly checked during application. Thinner is to be limited to those types and quantities recommended by the Manufacturer.	Type of gauge and calibration in accordance with SSPC-PA2:2004 Paint Application Specification No.2.
2. Primary surface preparation		
a) Blasting and profile	Sa $2^{1/2}$, with profiles between 30-75 µm Blasting is not to be carried out when: (i) the relative humidity is above 85%; or (ii) the surface temperature of steel is less than 3°C above the dew point. Checking of the steel surface cleanliness and roughness profile is to be carried out at the end of the surface preparation and before the application of the primer, in accordance with the Manufacturer's recommendations.	ISO 8501-1 ISO 8503-1/2
b) Water soluble salt limit equivalent to NaCl	≤ 50 mg/ m^2 of sodium chloride	ISO 8502-9
c) Shop primer	Zinc containing inhibitor free zinc silicate based or equivalent. Compatibility with main coating system is to be confirmed by the coating Manufacturer.	
3. Secondary surface preparation		
a) Steel condition	The steel surface is to be prepared so that the coating selected can achieve an even distribution at the required NDFT and have an adequate adhesion by removing sharp edges, grinding weld beads and removing weld spatter and any other surface contaminant in accordance with ISO 8501-3 grade P2. Edges are to be treated to a rounded radius of minimum 2 mm, or subjected to three pass grinding or at least equivalent process before painting.	ISO 8501-3

Item	Requirement	Reference standard
b) Surface treatment	Sa 2½ on damaged shop primer and welds. Sa 2 removing at least 70% of intact shop primer which has not passed a pre-qualification certified by test procedures specified in 1.c) of this Table. If the complete coating system comprising epoxy based main coating and shop primer has passed a pre-qualification certified by test procedures specified in 1.c) of this Table, intact shop primer may be retained provided the same epoxy coating system is used. The retained shop primer is to be cleaned by sweep blasting, high-pressure water washing or equivalent method. If a zinc silicate shop primer has passed the pre-qualification test specified in 1.c) of this Table, as part of an epoxy coating system, it may be used in combination with other epoxy coatings certified under 1.c) of this Table, provided that the compatibility has been confirmed by the manufacturer by the test with reference to the immersion test of App 4 or in accordance with the Performance standard for protective coatings for cargo oil tanks of crude oil tankers (resolution MSC.288(87)).	ISO 8501-1
c) Surface treatment after erection	Erection joints St 3 or better or Sa 2½ where practicable. For inner bottom: • Damages up to 20% of the area to be coated to be treated to minimum St 3. • Contiguous damage over 25 m^2 or over 20% of the area to be coated, Sa $2^{½}$ is to be applied. For underdeck: • Damages up to 3% of the area to be coated to be treated to minimum St 3. • Contiguous damage over 25 m^2 or over 3% of the area to be coated, Sa $2^{½}$ is to be applied. Coating in overlap to be feathered.	
d) Profile requirements	In the case of full or partial blasting 30-75 µm, otherwise as recommended by the coating Manufacturer.	ISO 8503-1/2
e) Dust	Dust quantity rating "1" for dust size class "3", "4" or "5". Lower dust size classes are to be removed if visible on the surface to be coated without magnification.	ISO 8502-3
f) Water soluble salts limit equivalent to NaCl after blasting/grinding	≤ 50 mg/ m^2 of sodium chloride	ISO 8502-9
g) Contamination	No oil contamination. Paint manufacturer's recommendations should be followed regarding any other contamination between coats.	
4. Miscellaneous		
a) Ventilation	Adequate ventilation is necessary for the proper drying and curing of coating. Ventilation is to be maintained throughout the application process and for a period after application is completed, as recommended by the coating Manufacturer.	
b) Environmental conditions	Coating is to be applied under controlled humidity and surface conditions, in accordance with the Manufacturer's specifications. In addition, coating is not to be applied when: (i) the relative humidity is above 85%; or (ii) the surface temperature is less than 3°C above the dew point; or (iii) any other requirements of the paint manufacturer are not being met.	

Item	Requirement	Reference standard
c) Testing of coating	Destructive testing is to be avoided. Sample dry film thickness is to be measured after each coat for quality control purposes and the total dry film thickness is to be confirmed after completion of final coat, using appropriate thickness gauges.	SSPC-PA2: 2004
d) Repair	Any defective areas, e.g. pin-holes, bubbles, voids, etc,. are to be marked up and appropriate repairs effected. All such repairs are to be re-checked and documented.	

2.5 Coating system approval

2.5.1 *(1/1/2023)*

Results from prequalification tests of the coating system (see 1.3 of Tab 1) are to be documented, and a Statement of Compliance or Type Approval Certificate is to be issued if found satisfactory by a third party, independent of the coating Manufacturer.

2.6 Coating inspection requirements

2.6.1 *(1/1/2023)*

The requirements in Sec 12, [2.6] apply.

2.7 Verification requirements

2.7.1 *(1/1/2023)*

The requirements in Sec 12, [2.7] apply.

2.8 Alternative systems

2.8.1 *(1/1/2023)*

All systems that are not an epoxy based system applied according to Tab 1 are defined as an alternative system.

2.8.2 *(1/1/2023)*

The requirements of this Section are based on recognised and commonly used coating systems. It is not meant to exclude other, alternative, systems with proven equivalent performance, for example non-epoxy based systems.

2.8.3 *(1/1/2023)*

Acceptance of alternative systems will be subject to documented evidence that they ensure a corrosion prevention performance at least equivalent to that indicated in this Section, by either:

a) testing according to this standard; or

b) The coating condition shall not be less than "GOOD" after five years.

3 Survey activities

3.1 General

3.1.1 *(1/1/2023)*

The requirements in Sec 12, [3] apply.

SECTION 44 DIGITAL SHIP (D)

1 General

1.1 Application

1.1.1 *(1/1/2023)*

The additional class notation **DIGITAL SHIP (D)** is assigned to ships fitted with one or more approved electronic system/digital tool complying with the requirements of this section.

A Certificate of Compliance may be issued to ships not classed with the Society, fulfilling the requirements of this section. The certificate of compliance is valid for a period of 5 years, subject to annual confirmation.

2 Definitions

2.1

2.1.1 *(1/1/2023)*

- Documentary data is the electronic collection of ship's records, logbooks and storage of other documents in electronic format.
- Data Storage is the operation of saving and retention of recorded data.
- Owner, in this section, means Ship Owner or Ship Management Company.
- Stored data is the value recorded with identification of the person that saved it and time saved.
- Data Signature is the identification of the person that recorded the data by ID and password or more stringent identification standards.
- Time stamp is the data reference time expressed in UTC.

3 Documents to be submitted

3.1

3.1.1 *(1/1/2023)*

The following documents are to be submitted for information:

a) list of software applications covered by the notation,

b) list of records, logbooks and documents managed,

c) list of data transferred ashore, when applicable,

d) software quality and maintenance documentation.

Depending on the ship arrangement and software, additional drawings or documents may be required at Society's discretion.

Documents under b), c) and d) are not required in case the software is type approved by the Society.

4 Requirements

4.1 General

4.1.1 *(1/1/2023)*

The ship is to be fitted with one or more approved electronic system/digital tool:

- enabling the collection on board of documentary data in place of paper copies;
- duplicated by a secondary means or by the possibility to transmit data ashore keeping synchronized the two data storage databases;
- capable of sharing stored data with the Society.

For those documents that are not generated by the company/crew and are provided in paper form as original, an electronic copy is to be uploaded and kept updated in the system under Owner's responsibility.

4.1.2 *(1/1/2023)*

Users are to be provided with personal ID and password to ensure that data are inserted by authorized personnel according to procedures and responsibility defined by ISM and/or, national/international regulations and/or other applicable standard/rules/procedures.

Depending on the data to be managed and the applicable standard/rules/procedures, stronger user authentication can be applied (such as MFA-Multi Factor Authentication).

Access to the data is to be monitored and secured by the Owner.

4.2 Data stored (Data Signature and Time Stamp)

4.2.1 *(1/1/2023)*

Data recorded on board are to be stored with association to the data source (e.g. person ID who uploaded/filled in the data or the reference to the automatic acquisition system) and the time when data were recorded (UTC time).

Any update to the data stored is to be associated to the data source (e.g. person ID who made the update) and the time at which the data was stored (UTC time).

4.3 Redundancy

4.3.1 *(1/1/2023)*

A data back-up is to be available in case of failure of the main computer/electronic system on board. The back-up can be on a secondary means on board or ashore.

In both cases synchronization between the main computer/electronic system on board and the back-up one, on board or ashore, is to be managed automatically by the system.

In case the back-up is ashore, stored data are to be transferred ashore automatically by an available trusted internet connection,

and operation of the system on board must not be impaired by the lack of internet or/and third parties' connectivity.

Evidence of last database synchronization with ashore is to be recorded and available to the Society for proper traceability.

4.4 Data shared with the Society

4.4.1 *(1/1/2023)*

The electronic system/digital tool is to be capable of providing to the Society a secure and trusted remote access to the data stored in the database on board or ashore, for the scope of verifying the documentation applicable to the surveys/audits/verifications/approvals performed by the Society for the ship or for the management company.

Access to data can be granted with direct access to the software and data itself or to defined reports/views.

The list in Tab 1 is provided as a guidance to identify if the data to which the Society can have access are in the scope of the surveys/audits/verifications/approvals performed by the Society.

Data not part of the list in Tab 1 can be evaluated on a case-by-case basis for the assignment of notation.

Table 1 List of data that can be accessible to the Society *(1/1/2023)*

ALL SHIPS	
Class	• Analysis of the quality of the oil for thermal oil boilers • Repairs and maintenance log book for boiler and incinerator • Last shaft seal oil analysis • Shaft bearing temperature (MONSHAFT notation) • PMS/CBM data
SOLAS	• Last annual service VDR - EPIRB - SART - AIS - LRIT - GMDSS last survey report • Last annual service: EEBD - Breathing Apparatus - Immersion Suit - Portable Fire extinguishers • Last Compass deviation table • Gas Detector last calibration • Last Annual and/or Biennial CO_2 Service • Last LSA Annual Service (lifeboats, liferafts, rescue boats) • Last Foam analysis of fixed fire extinguishing system • Last Sprinkler water chemical analysis (only for hi-fog system) • Log-book Drills (LSA and steering gear) • Alternative design SOLAS (if any, refer to details on SOLAS certificates) • Record of Condition of assignment of load lines • Intact stability booklet • Last version of the Continuous Synopsis Record • MES deployment calendar (if fitted) • Emergency towing arrangements (for oil tanker in approved form) • Approved Cargo securing Manual (for ship carrying dangerous goods)
MARPOL	• Oil Water Separator last calibration service (IOPP) • Oil record Book Part I • Garbage record book • Garbage management plan • Bunker delivery notes • SOPEP • EIAPP and Technical files for MMEE and DDGG • On board monitoring manual (OMM) of EGCS record book (scrubber if fitted) • Calibration of the monitoring equipment (if scrubber is fitted) • Fuel changeover procedures (if any)

ALL SHIPS	
ISM CODE	• SMS manual and relevant procedures and supporting forms/checklists • DOC certificate • Risk assessment procedures/policy • Cybersecurity procedures • Drills/exercises planning and relevant records • Man overboard procedures • PSC records and relevant follow-up documentation • Accident, near miss and non-conformity reports for injury/pollution and follow up by Company • Records of internal audits and findings follow-up documentation • Record of spare parts for critical equipment • Actual crew list • Crew training records • Maintenance on board records/documentation
BWM	• Ballast record book • Ballast management plan
Other	• Lifts - Escalator last service • Last PSC report • DCS Statement of Compliance • MRV Certificate of Compliance • MRV and DCS recordings • Officers STCW Certificates and Flag endorsement, when applicable
OIL and CHEMICAL TANKERS / BULK CARRIES	
• Oil record Book Part II • Repair history and Condition Evaluation Report • Ship Construction File • SMPEP for Chemical Tankers • SOPEP for Oil Tankers • Ship's structures and Access Manual • Intact and damage stability on loading computer • Ship technical coating file for Oil Tankers • Procedures & Arrangements Manual • Operating and Maintenance Manual for ODME and calibration certificate (MEPC.108(49)) • Cargo Record Book for Chemical Tankers • VOC Plan for Crude Oil Tankers	
RO-RO (CARGO and PAX) / CONTAINER SHIPS	
• Approved Cargo Securing Manual • Onboard Maintenance Manual (OMM) for all doors of Ro-Ro	
TUGS	
• Operating instructions of Emergency release system	

SECTION 45 FUEL SAMPLING

1 General

1.1 Application

1.1.1 *(1/1/2023)*

The additional class notation **FUEL SAMPLING** may be assigned, in accordance with Pt A, Ch 1, Sec 2, [6.14.67], to ships having the fuel oil supply system provided with sampling points complying with the requirements in Pt C, Ch 1, Sec 10, [11.10.5] and the additional ones in [2].

2 Requirements

2.1 General

2.1.1 *(1/1/2023)*

The sampling points in the fuel oil supply system are to comply with the requirements in [2.2] derived from IACS Recommendation for fuel oil treatment systems (IACS Rec.151).

2.2 Location of sampling points

2.2.1 *(1/1/2023)*

The sampling points are to be located as follows:

a) after the transfer pump discharge,

b) before and after the fuel cleaning equipment,

c) after the fuel oil service tank, before any fuel change over valve, and

d) before fuel enters the oil fuelled machinery (after fuel change over valve but before the booster pump).

2.2.2 *(1/1/2023)*

Sampling points are to be provided at locations within the fuel oil system that enable samples of fuel oil to be taken in a safe manner.

The sampling points are to be in positions as far away as possible from any heated surface or electrical equipment to preclude impingement of fuel oil onto such surfaces or equipment under all operating conditions.

2.2.3 *(1/1/2023)*

The positions of the sampling points are to be shown in the approved diagram of fuel oil system (Pt C, Ch 1, Sec 10, Tab 1) and the approved diagram is to be retained on board and presented to the surveyor during surveys.

APPENDIX 4 TEST PROCEDURES FOR COATING QUALIFICATION FOR CARGO OIL TANKS OF CRUDE OIL TANKERS

1 Scope

1.1

1.1.1 *(1/1/2023)*

This Appendix provides details of the test procedures referred to in Sec 43, Tab 1.

Both the tank-top and deck-head are to be applied with coating systems that have passed the full test protocol as described in this document.

2 Definitions

2.1

2.1.1 *(1/1/2023)*

Coating specification: means the specification of coating systems, which includes the type of coating system, steel preparation, surface preparation, surface cleanliness, environmental conditions, application procedure, acceptance criteria and inspection.

3 Testing

3.1

3.1.1 *(1/1/2023)*

The tests herein are designed to simulate, as far as practicable, the two main environmental conditions to which the crude oil cargo tank coating will be exposed. The coating is to be validated by the following tests: the test procedures is to comply with [5] and [6].

4 Test gas composition

4.1

4.1.1 *(1/1/2023)*

The test gas is based on the composition of the vapour phase in crude oil tanks, except that the hydrocarbon components are not included as these have no detrimental effect on epoxy coatings such as those used in cargo oil tanks.

Table 1 : Test Gas Composition *(1/1/2023)*

Item	
N_2	83 ± 2 per cent by volume of dry gas
CO_2	13 ± 2 per cent by volume of dry gas
O_2	4 ± 1 per cent by volume of dry gas
SO_2	300 ± 20 ppm
H_2S	200 ± 20 ppm

4.2 Test liquid

4.2.1 *(1/1/2023)*

Crude oil is a complex chemical material which is not stable over time when stocked. Crude oils can also vary in composition over time. In addition the use of crude oil has proven to create practical and HSE barriers for the involved testing institutes. To overcome this, a model immersion liquid is used to simulate crude oil. The formulation of this crude oil model system is given below:

a) start with distillate Marine Fuel, DMA Grade, according to ISO 8217:2005, density at 15ºC: maximum 890 kg/m^3, viscosity of maximum 6 mm^2/s at 40ºC;

b) add naphthenic acid up to an acid number, according to ISO 6618:1997, of 2.5 ± 0.1 mg KOH/g;

c) add benzene/ toluene (1:1 ratio) up to a total of 8.0 ± 0.2% w/w of the DMA;

d) add artificial seawater, according to ASTM D1141-98(2008), up to a total of 5.0 ± 0.2% w/w to the mixture;

e) add H_2S dissolved in a liquid carrier (in order to get 5 ± 1 ppm w/w H_2S in the total test liquid);

f) thoroughly mix the above constituents immediately prior to use; and

g) once the mixture is completed, it is to be tested to confirm the mixture is compliant with the test mixture concentrations.

Note 1: To prevent the risk of H_2S release into the test facility, it is recommended to use a stock solution for steps a) to d), then fill the test containers and complete the test solution with steps e) and f).

5 Gas-tight cabinet test

5.1 Test condition

5.1.1 *(1/1/2023)*

The vapour test is to be carried out in a gas-tight cabinet. The dimensions and design of the air tight gas cabinet are not critical, provided the requirements of items f) to j) below are met. The test gas is designed to simulate the actual crude oil cargo tank environment in ballast condition as well as the vapour conditions of the loaded tank.

a) The exposure time is 90 days.

b) Testing is to be carried out using duplicate panels; a third panel is to be prepared and stored at ambient conditions to act as a reference panel during final evaluation of the test panels.

c) The size of each test panel is 150 mm x 100 mm x 3 mm.

d) The panels are to be treated according to Sec 43, Tab 1, item 1.b) and the coating system applied according to Sec 43, Tab 1, items 1.d) and 1.e).

e) The zinc silicate shop primer, when used, is to be weathered for at least 2 months and cleaned by low pressure fresh water washing. The exact method of shop primer preparation before being over coated is to be reported, and the judgement issued for that specific system. The reverse side and edges of the test piece are to be coated appropriately, in order not to influence the test results.

f) Inside the gas-tight cabinet a trough is to be present. This trough is to be filled with 2 ± 0.2 l of water. The water in the trough sis to be drained and renewed prior to each time the test gas is refreshed.

g) The vapour spaces inside the gas-tight cabinet are to be filled with a mixture of test gas as per Sec 43, [2.5]. The cabinet atmosphere is to be maintained over the period of the test. When the gas is outside the scope of the test method, it is to be refreshed. The monitoring frequency and method, and the date and time for refreshing the test gas, are to be in the test report.

h) The atmosphere in the test cabinet is to at all times be 95 ± 5% relative humidity.

i) Temperature of the test atmosphere is to be 60 ± 3 C.

j) A stand for the test panels is to be made of a suitable inert material to hold the panels vertically spaced at least 20 mm between panels. The stand is to be positioned in the cabinet to ensure the lower edge of the panels is at least 200 mm above the height of the water and at least 100 mm from the walls of the cabinet. If two shelves are in the cabinet, care is to be taken to ensure solution does not drip on to the lower panels.

5.2 Test results

5.2.1 *(1/1/2023)*

Prior to testing, the following measured data of each coating composing the coating system, including the zinc silicate shop primer when used under the coating system, is to be reported:

a) infrared (IR) identification of the base and hardener components of the coating;

b) specific gravity, according to ISO 2811-1/4:1997, of the base and hardener components of the paint; and

c) mean dry film thickness (DFT) (by using the following template: six equally distributed measuring points are used on panels size 150 mm x 100 mm).

5.2.2 *(1/1/2023)*

After completion of the test duration, the panels are to be removed from the cabinet and rinsed with warm tap water. The panels are to be dried by blotting with absorbent paper and, then, evaluated for rust and blistering within 24 h of the end of the test.

5.2.3 *(1/1/2023)*

After testing, the following measured data is to be reported: blisters and rust (refer to ISO 4628:2003, ISO 4628-1:2003 and ISO 4628-2:2003).

5.3 Acceptance criteria

5.3.1 *(1/1/2023)*

The test results based on [5.2] are to satisfy the acceptance criteria indicated in Tab 2.

5.3.2 *(1/1/2023)*

When evaluating test panels, blistering or rusting within 5 mm of the panel edge is to be ignored.

Table 2 : Acceptance criteria of the results of condensation chamber test *(1/1/2023)*

Item	Acceptance criteria for epoxy-based systems	Acceptance criteria for alternative systems
Blisters on panel	No blisters	No blisters
Rust on panel	Ri 0 (0%)	Ri 0 (0%)

5.4 Test report

5.4.1 *(1/7/2006)*

The test report is to include the following information:

a) coating manufacturers' name and manufacturing site;

b) dates of test;

c) product name/identification of each coat and, where applicable, zinc silicate shop primer;

d) batch numbers of each component of each product;

e) details of surface preparation of steel panels, before shop primer application, and treatment of the shop primer before over coating where relevant and at a minimum including the following:

1) surface treatment, or treatment of weathered shop primer, and any other important information on treatment influencing the performance; and

2) water soluble salt level measured on the steel prior to application of the shop primer (refer to ISO 8502-6:2006 and ISO 8502-9:1998);

f) details of coating system, including the following:

1) zinc silicate shop primer if relevant, its secondary surface pre-treatment and condition under which applied, weathering period;

2) number of coats, including the shop primer, and thickness of each;

3) mean dry film thickness (DFT) prior to testing;

4) thinner if used

5) humidity;

6) air temperature; and

7) steel temperature;

g) details of schedule for refreshing the test gas;

h) test results according to [5.2]; and

i) results according to [5.3].

6 Immersion test

6.1

6.1.1 *(1/1/2023)*

The immersion test is developed to simulate the conditions in a crude oil tank in loaded condition.

a) The exposure time is 180 days.

b) The test liquid is to be made as per item 6 in the Standard.

c) The test liquid is to be added to a container with an inside flat bottom until a column of the test liquid of height of 400 mm is reached, resulting in an aqueous phase of 20 mm. Any other alternative test set-up, using an identical test liquid, which will also result in the immersion of the test panel in 20 mm of the aqueous phase, is also accepted. This can be achieved by using, for instance, inert marbles.

d) The temperature of the test liquid is to be 60 ± 2 C and is to be uniform and maintained constant with recognized methods such as water or oil bath or air circulation oven capable of keeping the immersion liquid within the required temperature range.

e) Test panels is to be positioned vertically and fully immersed during the test.

f) Testing is to be carried out using duplicate panels.

g) Inert spacers which do not cover the test area is to be used to separate test panels.

h) The size of each test panel is 150 mm x 100 mm x 3 mm.

i) The panels are to be treated according to Sec 43, Tab 1, items 1.b) and the coating system applied according to Sec 43, Tab 1, items 1.d) and 1.e).

j) The zinc silicate shop primer, when used, is to be weathered for at least 2 months and cleaned by low pressure fresh water washing. The exact method of shop primer preparation before being over coated is to be reported, and the judgement issued for that specific system. The reverse side, and edges, of the test piece is to be coated appropriately, in order not to influence the test results

k) After the full immersion test period is completed the panels are to be removed from the test liquid and wiped with dry clean cloth before evaluation of the panels.

l) Evaluation of the test panels is to be done within 24 h after completion of the test.

6.2 Test results

6.2.1 *(1/1/2023)*

Prior to testing, the following measured data of each coating composing the coating system, including the zinc silicate shop primer when used under the coating system, is to be reported:

a) infrared (IR) identification of the base and hardener components of the coating;

b) specific gravity, according to ISO 2811-1/4:1997, of the base and hardener components of the paint; and

c) mean dry film thickness (DFT) (by using the following template: six equally distributed measuring points are used on panels size 150 mm x 100 mm).

6.2.2 *(1/1/2023)*

After testing, the following measured data is to be reported: blisters and rust (refer to ISO 4628:2003, ISO 4628-1:2003 and ISO 4628-2:2003).

6.3 Acceptance criteria

6.3.1 *(1/1/2023)*

The test results based on [6.2] are to satisfy the acceptance criteria indicated in Tab 2.

6.3.2 *(1/1/2023)*

When evaluating test panels, blistering or rusting within 5 mm of the panel edge is to be ignored.

6.4 Test report

6.4.1 *(1/1/2023)*

The test report is to include the following information:

a) coating manufacturers' name and manufacturing site;

b) dates of test;

c) product name/identification of each coat and, where applicable, zinc silicate shop primer;

d) batch numbers of each component of each product;

e) details of surface preparation of steel panels, before shop primer application, and treatment of the shop primer before over coating where relevant and at a minimum including the following:

1) surface treatment, or treatment of weathered shop primer, and any other important information on treatment influencing the performance; and

2) water soluble salt level measured on the steel prior to application of the shop primer (refer to ISO 8502-6:2006 and ISO 8502-9:1998);

f) details of coating system, including the following:

1) zinc silicate shop primer if relevant, its secondary surface pre-treatment and condition under which applied, weathering period;

2) number of coats, including the shop primer, and thickness of each;

3) mean dry film thickness (DFT) prior to testing;

4) thinner if used

5) humidity;

6) air temperature; and

7) steel temperature;

g) test results according to [6.2]; and

h) results according to [6.3].

7 Precautions regarding the use of dangerous materials

7.1

7.1.1 *(1/1/2023)*

The test methods involve the use of materials that may be hazardous to health as follows:

a) Sulphur Dioxide: Corrosive when wet, toxic if inhaled, causes burns, and is an irritant to the eyes and respiratory system.

b) Hydrogen Sulphide: Highly flammable (Flash point of -82°C), can form an explosive mixture with air, corrosive when wet, causes burns, has to be kept away from sources of ignition, irritant and asphyxiant, LTEL 5 ppm, STEL 10 ppm, higher concentrations can be fatal and have no odour. Repeated exposure to low concentrations can result in the sense of smell for the gas being diminished.

c) Benzene: Highly flammable (Flash point of -11 C), can form an explosive mixture with air, toxic, carcinogenic, acute health risk.

d) Toluene: Highly flammable (Flash point of 4 C), can form an explosive mixture with air, irritant, acute health risk, reprotoxin.

7.1.2 *(1/1/2023)*

Special test apparatus and precautions may be required depending on the regulations in force in the country where the tests are carried out.

7.1.3 *(1/1/2023)*

Although some countries have no specific requirements preventing either of the tests being carried out, it is to anyhow be required that:

a) a risk assessment of the working conditions is carried out;

b) during the test period, the system is to be enclosed; and

c) the environment is to be controlled, particularly at the start and end of the tests, suitable air exhaust is to be available and personal protective equipment is to be worn.