Rules for the Classification of Steel Ships

NR 467

AMENDMENTS

July 2020

These sheets contain amendments within the following Sections of January 2020 issue of the *Rules for the Classification of Steel Ships*.

These amendments are effective from July 1st, 2020.

Part	Volume	Chapter	Section / Appendix
Part A	*NR 467 A1 DT R17 E*	Ch 1	Sec 2
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		Ch 3	Sec 1, Sec 2, Sec 4, App 1
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		Ch 5	Sec 2, Sec 7, Sec 10
		Ch 6	Sec 2
Part B	*NR 467 B1 DT R12 E*	Ch 1	Sec 2
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Part C	*NR 467 C1 DT R12 E*	Ch 1	Sec 1, Sec 2, Sec 9, Sec 10, Sec 11, Sec 12, Sec 15, App 3
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BUREAU VERITAS MARINE & OFFSHORE

GENERAL CONDITIONS

1. INDEPENDENCE OF THE SOCIETY AND APPLICABLE TERMS

1.1 The Society shall remain at all times an independent contractor and neither the Society nor any of its officers, employees, servants, agents or subcontractors shall be or act as an employee, servant or agent of any other party hereto in the performance of the Services.

1.2 The operations of the Society in providing its Services are exclusively conducted by way of random inspections and do not, in any circumstances, involve monitoring or exhaustive verification.

1.3 The Society acts as a services provider. This cannot be construed as an obligation bearing on the Society to obtain a result or as a warranty. The Society is not and may not be considered as an underwriter, broker in Unit's sale or chartering, expert in Unit's valuation, consulting engineer, controller, naval architect, designer, manufacturer, shipbuilder, repair or conversion yard, charterer or shipowner; none of them above listed being relieved of any of their expressed or implied obligations as a result of the interventions of the Society.

1.4 The Society only is qualified to apply and interpret its Rules.

1.5 The Client acknowledges the latest versions of the Conditions and of the applicable Rules applying to the Services' performance.

1.6 Unless an express written agreement is made between the Parties on the applicable Rules, the applicable Rules shall be the Rules applicable at the time of entering into the relevant contract for the performance of the Services.

1.7 The Services' performance is solely based on the Conditions. No other terms shall apply whether express or implied.

2. DEFINITIONS

2.1 **"Certificate(s)"** means classification or statutory certificates, attestations and reports following the Society's intervention.

2.2 **"Certification"** means the activity of certification in application of national and international regulations or standards, in particular by delegation from different governments that can result in the issuance of a Certificate.

2.3 **"Classification"** means the classification of a Unit that can result or not in the issuance of a classification Certificate with reference to the Rules. Classification is an appraisement given by the Society to the Client, at a certain date, following surveys by its surveyors on the level of compliance of the Unit to the Society's Rules or to the documents of reference for the Services provided. They cannot be construed as an implied or express warranty of safety, fitness for the purpose, seaworthiness of the Unit or of its value for sale, insurance or chartering.

2.4 **"Client"** means the Party and/or its representative requesting the Services.

2.5 **"Conditions"** means the terms and conditions set out in the present document.

2.6 **"Industry Practice"** means international maritime and/or offshore industry practices.

2.7 **"Intellectual Property"** means all patents, rights to inventions, utility models, copyright and related rights, trade marks, logos, service marks, trade dress, business and domain names, rights in trade dress or get-up, rights in goodwill or to sue for passing off, unfair competition rights, rights in designs, rights in computer software, database rights, topography rights, moral rights, rights in confidential information (including know-how and trade secrets), methods and protocols for Services, and any other intellectual property rights, in each case whether capable of registration, registered or unregistered and including all applications for and renewals, reversions or extensions of such rights, and all similar or equivalent rights or forms of protection in any part of the world.

2.8 **"Parties"** means the Society and Client together.

2.9 **"Party"** means the Society or the Client.

2.10 **"Register"** means the public electronic register of ships updated regularly by the Society.

2.11 **"Rules"** means the Society's classification rules and other documents. The Society's Rules take into account at the date of their preparation the state of currently available and proven technical minimum requirements but are not a standard or a code of construction neither a guide for maintenance, a safety handbook or a guide of professional practices, all of which are assumed to be known in detail and carefully followed at all times by the Client.

2.12 **"Services"** means the services set out in clauses 2.2 and 2.3 but also other services related to Classification and Certification such as, but not limited to: ship and company safety management certification, ship and port security certification, maritime labour certification, training activities, all activities and duties incidental thereto such as documentation on any supporting means, software, instrumentation, measurements, tests and trials on board. The Services are carried out by the Society according to the applicable referential and to the Bureau Veritas' Code of Ethics. The Society shall perform the Services according to the applicable national and international standards and Industry Practice and always on the assumption that the Client is aware of such standards and Industry Practice.

2.13 **"Society"** means the classification society **'Bureau Veritas Marine & Offshore SAS'**, a company organized and existing under the laws of France, registered in Nanterre under number 821 131 844, or any other legal entity of Bureau Veritas Group as may be specified in the relevant contract, and whose main activities are Classification and Certification of ships or offshore units.

2.14 **"Unit"** means any ship or vessel or offshore unit or structure of any type or part of it or system whether linked to shore, river bed or sea bed or not, whether operated or located at sea or in inland waters or partly on land, including submarines, hovercrafts, drilling rigs, offshore installations of any type and of any purpose, their related and ancillary equipment, subsea or not, such as well head and pipelines, mooring legs and mooring points or otherwise as decided by the Society.

3. SCOPE AND PERFORMANCE

3.1 Subject to the Services requested and always by reference to the Rules, the Society shall:

- review the construction arrangements of the Unit as shown on the documents provided by the Client;
- conduct the Unit surveys at the place of the Unit construction;
- class the Unit and enter the Unit's class in the Society's Register;
- survey the Unit periodically in service to note whether the requirements for the maintenance of class are met.

The Client shall inform the Society without delay of any circumstances which may cause any changes on the conducted surveys or Services.

3.2 The Society will not:

- declare the acceptance or commissioning of a Unit, nor its construction in conformity with its design, such activities remaining under the exclusive responsibility of the Unit's owner or builder;
- engage in any work relating to the design, construction, production or repair checks, neither in the operation of the Unit or the Unit's trade, neither in any advisory services, and cannot be held liable on those accounts.

4. RESERVATION CLAUSE

4.1 The Client shall always: (i) maintain the Unit in good condition after surveys; (ii) present the Unit for surveys; and (iii) inform the Society in due time of any circumstances that may affect the given appraisement of the Unit or cause to modify the scope of the Services.

4.2 Certificates are only valid if issued by the Society.

4.3 The Society has entire control over the Certificates issued and may at any time withdraw a Certificate at its entire discretion including, but not limited to, in the following situations: where the Client fails to comply in due time with instructions of the Society or where the Client fails to pay in accordance with clause 6.2 hereunder.

4.4 The Society may at times and at its sole discretion give an opinion on a design or any technical element that would 'in principle' be acceptable to the Society. This opinion shall not presume on the final issuance of any Certificate or on its content in the event of the actual issuance of a Certificate. This opinion shall only be an appraisal made by the Society which shall not be held liable for it.

5. ACCESS AND SAFETY

5.1 The Client shall give to the Society all access and information necessary for the efficient performance of the requested Services. The Client shall be the sole responsible for the conditions of presentation of the Unit for tests, trials and surveys and the conditions under which tests and trials are carried out. Any information, drawing, etc. required for the performance of the Services must be made available in due time.

5.2 The Client shall notify the Society of any relevant safety issue and shall take all necessary safety-related measures to ensure a safe work environment for the Society or any of its officers, employees, servants, agents or subcontractors and shall comply with all applicable safety regulations.

6. PAYMENT OF INVOICES

6.1 The provision of the Services by the Society, whether complete or not, involve, for the part carried out, the payment of fees thirty (30) days upon issuance of the invoice.

6.2 Without prejudice to any other rights hereunder, in case of Client's payment default, the Society shall be entitled to charge, in addition to the amount not properly paid, interests equal to twelve (12) months LIBOR plus two (2) per cent as of due date calculated on the number of days such payment is delinquent. The Society shall also have the right to withhold Certificates and other documents and/or to suspend or revoke the validity of Certificates.

6.3 In case of dispute on the invoice amount, the undisputed portion of the invoice shall be paid and an explanation on the dispute shall accompany payment so that action can be taken to solve the dispute.

7. LIABILITY

7.1 The Society bears no liability for consequential loss. For the purpose of this clause consequential loss shall include, without limitation:

- Indirect or consequential loss;
- Any loss and/or deferral of production, loss of product, loss of use, loss of bargain, loss of revenue, loss of profit or anticipated profit, loss of business and business interruption, in each case whether direct or indirect.

The Client shall defend, release, save, indemnify, defend and hold harmless the Society from the Client's own consequential loss regardless of cause.

7.2 Except in case of wilful misconduct of the Society, death or bodily injury caused by the Society's negligence and any other liability that could not be, by law, limited, the Society's maximum liability towards the Client is limited to one hundred and fifty per-cents (150%) of the price paid by the Client to the Society for the Services having caused the damage. This limit applies to any liability of whatsoever nature and howsoever arising, including fault by the Society, breach of contract, breach of warranty, tort, strict liability, breach of statute.

7.3 All claims shall be presented to the Society in writing within three (3) months of the completion of Services' performance or (if later) the date when the events which are relied on were first discovered by the Client. Any claim not so presented as defined above shall be deemed waived and absolutely time barred.

8. INDEMNITY CLAUSE

8.1 The Client shall defend, release, save, indemnify and hold harmless the Society from and against any and all claims, demands, lawsuits or actions for damages, including legal fees, for harm or loss to persons and/or property tangible, intangible or otherwise which may be brought against the Society, incidental to, arising out of or in connection with the performance of the Services (including for damages arising out of or in connection with opinions delivered according to clause 4.4 above) except for those claims caused solely and completely by the gross negligence of the Society, its officers, employees, servants, agents or subcontractors.

9. TERMINATION

9.1 The Parties shall have the right to terminate the Services (and the relevant contract) for convenience after giving the other Party thirty (30) days' written notice, and without prejudice to clause 6 above.

9.2 In such a case, the Classification granted to the concerned Unit and the previously issued Certificates shall remain valid until the date of effect of the termination notice issued, subject to compliance with clause 4.1 and 6 above.

9.3 In the event where, in the reasonable opinion of the Society, the Client is in breach, or is suspected to be in breach of clause 16 of the Conditions, the Society shall have the right to terminate the Services (and the relevant contracts associated) with immediate effect.

10. FORCE MAJEURE

10.1 Neither Party shall be responsible or liable for any failure to fulfil any term or provision of the Conditions if and to the extent that fulfilment has been delayed or temporarily prevented by a force majeure occurrence without the fault or negligence of the Party affected and which, by the exercise of reasonable diligence, the said Party is unable to provide against.

10.2 For the purpose of this clause, force majeure shall mean any circumstance not being within a Party's reasonable control including, but not limited to: acts of God, natural disasters, epidemics or pandemics, wars, terrorist attacks, riots, sabotages, impositions of sanctions, embargoes, nuclear, chemical or biological contaminations, laws or action taken by a government or public authority, quotas or prohibition, expropriations, destructions of the worksite, explosions, fires, accidents, any labour or trade disputes, strikes or lockouts.

11. CONFIDENTIALITY

11.1 The documents and data provided to or prepared by the Society in performing the Services, and the information made available to the Society, are treated as confidential except where the information:

- is properly and lawfully in the possession of the Society;
- is already in possession of the public or has entered the public domain, otherwise than through a breach of this obligation;
- is acquired or received independently from a third party that has the right to disseminate such information;
- is required to be disclosed under applicable law or by a governmental order, decree, regulation or rule or by a stock exchange authority (provided that the receiving Party shall make all reasonable efforts to give prompt written notice to the disclosing Party prior to such disclosure.

11.2 The Parties shall use the confidential information exclusively within the framework of their activity underlying these Conditions.

11.3 Confidential information shall only be provided to third parties with the prior written consent of the other Party. However, such prior consent shall not be required when the Society provides the confidential information to a subsidiary.

11.4 Without prejudice to sub-clause 11.1, the Society shall have the right to disclose the confidential information if required to do so under regulations of the International Association of Classifications Societies (IACS) or any statutory obligations.

12. INTELLECTUAL PROPERTY

12.1 Each Party exclusively owns all rights to its Intellectual Property created before or after the commencement date of the Conditions and whether or not associated with any contract between the Parties.

12.2 The Intellectual Property developed by the Society for the performance of the Services including, but not limited to drawings, calculations, and reports shall remain the exclusive property of the Society.

13. ASSIGNMENT

13.1 The contract resulting from to these Conditions cannot be assigned or transferred by any means by a Party to any third party without the prior written consent of the other Party.

13.2 The Society shall however have the right to assign or transfer by any means the said contract to a subsidiary of the Bureau Veritas Group.

14. SEVERABILITY

14.1 Invalidity of one or more provisions does not affect the remaining provisions.

14.2 Definitions herein take precedence over other definitions which may appear in other documents issued by the Society.

14.3 In case of doubt as to the interpretation of the Conditions, the English text shall prevail.

15. GOVERNING LAW AND DISPUTE RESOLUTION

15.1 These Conditions shall be construed and governed by the laws of England and Wales.

15.2 The Parties shall make every effort to settle any dispute amicably and in good faith by way of negotiation within thirty (30) days from the date of receipt by either one of the Parties of a written notice of such a dispute.

15.3 Failing that, the dispute shall finally be settled under the Rules of Arbitration of the Maritime Arbitration Chamber of Paris ("CAMP"), which rules are deemed to be incorporated by reference into this clause. The number of arbitrators shall be three (3). The place of arbitration shall be Paris (France). The Parties agree to keep the arbitration proceedings confidential.

16. PROFESSIONAL ETHICS

16.1 Each Party shall conduct all activities in compliance with all laws, statutes, rules, economic and trade sanctions (including but not limited to US sanctions and EU sanctions) and regulations applicable to such Party including but not limited to: child labour, forced labour, collective bargaining, discrimination, abuse, working hours and minimum wages, anti-bribery, anti-corruption, copyright and trademark protection, personal data protection (https://personaldataprotection.bureauveritas.com/privacypolicy).

Each of the Parties warrants that neither it, nor its affiliates, has made or will make, with respect to the matters provided for hereunder, any offer, payment, gift or authorization of the payment of any money directly or indirectly, to or for the use or benefit of any official or employee of the government, political party, official, or candidate.

16.2 In addition, the Client shall act consistently with the Bureau Veritas' Code of Ethics. https://group.bureauveritas.com/group/corporate-social-responsibility

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Part	Volume	Chapter	Section / Appendix
Part D	*NR 467 D1 DT R12 E*	Ch 2 Ch 4 Ch 9	Sec 2 Sec 3 Sec 1, Sec 4, Sec 5, Sec 7, Sec 8, Sec 11 Sec 13, Sec 16
Part E	*NR 467 E1 DT R03 E*	Ch 1	Sec 1, Sec 2, Sec 3, Sec 5, App 1
Part F	*NR 467 F1 DT R12 E*	Ch 2 Ch 3 Ch 9 Ch 11	Sec 2 Sec 1 Sec 1 Sec 2, Sec 5, Sec 13, Sec 21, Sec 23, Sec 26

Amendments to PART A

Ch 1, Sec 2, Table 1

Insert the following new row "Anchor handling".

Replace the rows "Escort tug", "Salvage tug" and "Tug".

Insert the following new row "SMART( )" in "other additional service features".

Table 1 : List of service notations and additional service features

Service notation [ref. in Part A] **Additional service feature**	Reference Reference	Corresponding type of ship according to Conventions and/or Codes
Anchor handling [4.8.2]	Part E, Chapter 2	Cargo ship (SOLAS, Reg I/2(g))
Escort tug [4.7.4]	Part E, Chapter 1	Cargo ship (SOLAS, Reg I/2(g))
barge combined	Pt E, Ch 1, Sec 4	
(design bollard pull = [T_{BP}/9,81] t)	Pt E, Ch 1, Sec 1	
(design maximum braking force = [$T_{X,MAX}$/9,81] t)	Pt E, Ch 1, Sec 1	
(design maximum escort speed = [V_{MAX}] kN)	Pt E, Ch 1, Sec 1	
(design maximum steering force = [$T_{Y,MAX}$/9,81] t)	Pt E, Ch 1, Sec 1	
(standardized design bollard pull = [T_{BP}/9,81] t)	Pt E, Ch 1, Sec 1	
Salvage tug [4.7.3]	Part E, Chapter 1	Cargo ship (SOLAS, Reg I/2(g))
barge combined	Pt E, Ch 1, Sec 4	
(design bollard pull = [T_{BP}/9,81] t)	Pt E, Ch 1, Sec 1	
(standardized design bollard pull = [T_{BP}/9,81] t)	Pt E, Ch 1, Sec 1	
Tug [4.7.2]	Part E, Chapter 1	Cargo ship (SOLAS, Reg I/2(g))
barge combined	Pt E, Ch 1, Sec 4	
(design bollard pull = [T_{BP}/9,81] t)	Pt E, Ch 1, Sec 1	
(standardized design bollard pull = [T_{BP}/9,81] t)	Pt E, Ch 1, Sec 1	
OTHER ADDITIONAL SERVICE FEATURES		Remarks
SMART( ) [4.17.8]		Service feature to be completed between brackets by at least 1 of the following notations: **H1**, **M1**, **N1**.

Ch 1, Sec 2, Table 2

Replace rows "anchor handling" and "tug" as follows:

Table 2 : List of service notations and additional service features for offshore service vessels

Service notation [ref. in Part A] **Additional service feature**	Associated service notation [ref. in Part A] **Additional service feature**	Reference Reference
Offshore support vessel [4.9.4]	**anchor handling** [4.8.2]	Part E, Chapter 2
	tug [4.7] **(1)**	Part E, Chapter 1
	(design bollard pull = [T_{BP}/9,81] t)	Pt E, Ch 1, Sec 1
	(standardized design bollard pull = [T_{BP}/9,81] t)	Pt E, Ch 1, Sec 1

Ch 1, Sec 2, [4.7.1]

Replace the 4th paragraph by:

These service notations are always completed by the additional service feature **(standardized design bollard pull = [T_{BP}/9,81] t)**.

Note 1: Ships contracted for construction before 1 July 2020 and not meeting the bollard pull test requirements for the assignment of the additional service feature **(standardized design bollard pull = [T_{BP}/9,81] t)** are assigned the additional service feature **(design bollard pull = [TBP/9,81] t)**, subject to bollard pull tests being carried out according to a procedure accepted by the Society.

The requirements for the assignment and the maintenance of this additional service feature are given respectively in Part E, Chapter 1 and Ch 4, Sec 8, [6].

Ships granted with the additional service feature **(design bollard pull = [T_{BP}/9,81] t)** may be granted with the additional service feature **(standardized design bollard pull = [T_{BP}/9,81] t)** after having satisfactorily carried out the bollard pull test laid down in Pt E, Ch 1, App 1.

Ch 1, Sec 2, [4.8]

Insert the following new requirement [4.8.2]:

4.8.2 Anchor handling vessel

The service notation anchor handling is assigned to towing vessels and/or supply vessels equipped with winches for anchor handling, having an open stern to allow the decking of anchors and an appropriate thrust to perform the intended anchor handling operations, consisting in deployment, recovering and repositioning of anchors and the associated mooring lines of rigs or other vessels. The additional requirements of Ch 4, Sec 8, [10] and Part E, Chapter 2 are applicable to these ships.

Note 1: As a rule, the service notation **tug** is also to be assigned in combination with the service notation **anchor handling vessel**; the additional requirements of Ch 4, Sec 8, [6] and Part E, Chapter 1 are applicable to these ships

Ch 1, Sec 2, [4.9.4]

Replace the second item in the bulleted list by:

- **anchor handling** (as defined in [4.8.2])

Ch 1, Sec 2, [4.9]

Delete requirement [4.9.9].

Ch 1, Sec 2, [4.17]

Add the following new requirement [4.17.8]:

4.17.8 Smart systems

The additional service feature **SMART( )** is assigned to ships fitted with computerized based system that incorporates functions for automatically collecting and analysing data.

These smart functions may include monitoring, decisions making support based on the available data and smart actions such as remote monitoring, maintenance from shore or remote operation of the system.

The requirements for the assignment of the additional service feature **SMART( )** consist of compliance with the requirement for notation **H1**, **M1** or **N1** defined here below.

The additional service feature **SMART( )** is to be completed between bracket by at least one of the following notation indicating the scope of application of the smart function:

- **H1** for hull, subject to compliance with the requirements for the assignment of the additional class notation **MON-HULL**
- **M1** for machinery, subject to compliance with the requirements for the assignment of additional class notations **AUT-IMS** and **MONSHAFT**
- **N1** for navigation, subject to compliance with the requirements for the assignment of the additional class notation **SYS-IBS-1**.

Note 1: The additional class notations **AUT-IMS** and **SYS-IBS-1** may be complemented by the notation **-HWIL** when the control system has been verified according to the requirements of NR632, Hardware-in-the-loop Testing, as laid down in [6.4.5] and [6.5.3].

Example: **SMART(H1,M1)**.

The requirements for the maintenance of this additional service feature are those corresponding to each additional class notation assigned.

Ch 1, Sec 2, Table 3

Replace the rows "CYBER MANAGED" and "CYBER SECURE" by:

Table 3: List of additional class notations

Additional class notation	Definition in	Reference in NR 467 or to other Rule Notes	Remarks
CYBER MANAGED **CYBER MANAGED PREPARED**	[6.14.44]	NR 659	
CYBER SECURE **(1)** **CYBER SECURE PREPARED** **(1)**	[6.14.44]	NR 659	

Ch 1, Sec 2, [6.8]

Replace requirement [6.8.15] as follows:

6.8.15 Ultra-low emission vessel (ULEV)

The additional class notation **ULEV** may be assigned to sea-going ships. The additional class notation **ULEV** may not be assigned to vessels dedicated to operations on inland waterways (including estuaries, rivers, estuary and lakes) falling into the scope of EU Regulation 2016/128.

The additional class notation **ULEV** refers to the capacity of the internal combustion engines installed on a ship to emit gaseous pollutants and particular pollutants at a very low level at the time of assignment of the notation.

When granting the additional class notation **ULEV**, a memoranda is to be endorsed in order to record the list of engines covered, the fuel(s) with which they have been tested and their ULEV mode if any.

The requirements for the assignment and the maintenance of this notation are given respectively in Pt F, Ch 11, Sec 26 and in Ch 5, Sec 7.

Ch 1, Sec 2, [6.14]

Replace requirement [6.14.44] as follows:

6.14.44 Cyber security

The additional class notations **CYBER MANAGED**, **CYBER SECURE**, **CYBER MANAGED PREPARED** and **CYBER SECURE PREPARED** may be assigned to ships whose systems and equipment comply with the requirements of NR659 Rules on Cyber Security for the Classification of Marine Units.

The additional class notation **CYBER MANAGED PREPARED** may be assigned to new buildings only and corresponds to compliance, at shipyard level, with a set of requirements dealing with system integration and the management of critical equipment and remote access:

- Granting of **CYBER MANAGED PREPARED** notation does not indicate an effective control of cyber security on-board ship during service life.
- When compliance with the dedicated requirement for management, crew training and change management are met, **CYBER MANAGED PREPARED** notation may be replaced by the additional class notation **CYBER MANAGED**.

The additional class notation **CYBER MANAGED** introduces on board operations dedicated to cyber security:

- The additional class notation **CYBER MANAGED** may be assigned to new buildings or ships in-service and corresponds to compliance with a set of requirements dealing with critical equipment management, crew training, remote access and change management.
- Granting of **CYBER MANAGED** notation implies that cyber security of the ship is controlled with manual procedures, requiring human actions, a strong human organization and a significant amount of procedures to achieve objective.

CYBER SECURE and **CYBER SECURE PREPARED** notations distinguish a way to control cyber security by means of automatic software. They requires dedicated technical equipment for security:

- The additional class notation **CYBER SECURE PREPARED** may be assigned to new buildings only and corresponds to compliance, at shipyard level, with a set of requirements dealing with equipment hardening and vessel secure by design.
- When compliance with the dedicated requirement for cyber management are met, **CYBER SECURE PREPARED** notation may be replaced by the additional class notation **CYBER SECURE**.
- The additional class notation **CYBER SECURE** may be assigned to new buildings or ships in-service already granted with **CYBER SECURE PREPARED** additional class notation and corresponds to compliance with a set of requirements dealing with cyber management, equipment hardening and vessel secure by design.

In compliance with [6.1.3], the additional class notation **CYBER SECURE** and **CYBER SECURE PREPARED** are assigned a construction mark, as defined in Article [3].

The requirements for the assignment of these notations are given in NR659, Rules on Cyber Security for the Classification of Marine Units.

The requirements for the maintenance of the notations **CYBER MANAGED** and **CYBER SECURE** are given in Ch 5, Sec 10.

Ch 2, Sec 2, [1.2.2]

Replace item c) by the following one:

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.

Ch 2, Sec 2, [2.1]

Replace requirements [2.1.5] and [2.1.6] as follows:

2.1.5 Conditions of class

A defect and/or deficiency to be dealt with in order to maintain class, within a specific period of time, is indicated as a condition of class. A condition of class is pending until it is cleared, through a survey by the attending Surveyor or upon evidence that requirements have been completed, to the satisfaction of the Society. Where it is not cleared by its limit date, the condition of class is overdue.

Condition of class may be imposed in other cases, which, in the Society's opinion, require specific consideration.

2.1.6 Memoranda

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 condition of class.

Ch 2, Sec 2, [2.2.1]

Delete the last paragraph of the requirement.

Ch 2, Sec 2, [2.2]

Replace requirement [2.2.17] as follows:

2.2.17 Prompt and thorough repair

A "Prompt and thorough repair" is a permanent repair completed at the time of survey to the satisfaction of the Surveyor, therein removing the need for the imposition of any associated condition of class. See also [2.11].

Ch 2, Sec 2, [2.6.2]

Replace the first paragraph by the following one:

For survey in cargo holds and ballast tanks, one or more of the following means for access, acceptable to the Surveyor, is to be provided:

Ch 2, Sec 2, [2.11]

Replace requirement [2.11.4] as follows:

2.11.4 Where the damage found on structure mentioned in [2.11.1] is isolated and of a localised nature which does not affect the ship's structural integrity, consideration may be given by the Surveyor to allow an appropriate temporary repair to restore watertight or weathertight integrity and impose a condition of class in accordance with the Rules, with a specific time limit.

Ch 2, Sec 2, [3.2]

Replace requirement [3.2.4] as follows:

3.2.4 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.

Ch 2, Sec 2, [3]

Replace Sub-article [3.4] as follows:

3.4 Status of surveys and conditions of class

3.4.1 Information given in the Certificate of Classification, ship survey status, Rules and other ship specific documents made available to the Owner, enables the Owner to identify the status of surveys and conditions of class.

3.4.2 The omission of such information does not absolve the Owner from ensuring that surveys are held by the limit dates and pending conditions of class are cleared to avoid any inconvenience which is liable to result from the suspension or withdrawal of class; see Ch 2, Sec 3.

Ch 2, Sec 2, [4.4]

Replace requirement [4.4.7] as follows:

4.4.7 Surveys of machinery may be carried out on a condition based maintenance (CBM) scheme basis on vessels operating on approved PMS survey system.

Ch 2, Sec 2, [6.1.2]

Replace the last bullet of the bulleted list by the following one:

- postponement of surveys or conditions of class.

Ch 2, Sec 2, [6.2]

Replace requirements [6.2.4] and [6.2.5] as follows:

6.2.4 Damages and partial or temporary repairs considered acceptable by the Surveyor for a limited period of time are the subject of an appropriate condition of class.

6.2.5 Damages or repairs required by the Surveyor to be re-examined after a certain period of time are the subject of an appropriate condition of class.

Ch 2, Sec 3, [1.2.4]

Replace the first bullet of the bulleted list by the following one:

- when a condition of class is not dealt with within the time limit specified, unless it is postponed before the limit date by agreement with the Society

Ch 2, App 1, [5.3]

Replace requirement [5.3.1] as follows:

5.3.1 Damage to components or items of machinery covered by the PMS which may affect the class is to be reported to the Society. Where applicable, a Surveyor will attend on board, survey the damaged items and, on the basis of the survey results, decide whether conditions of class are to be imposed.

Replace requirement [5.3.3] as follows:

5.3.3 In the case of overdue condition of class or records of unrepaired damage which may affect the PMS, the relevant items are to be taken out of the PMS until the conditions of class have been fulfilled or the repairs carried out.

Ch 2, App 3, Table 1

Replace the rows "liquefied gas carrier and" "general cargo ship" by:

Table 1 : References to rule requirements related to thickness measurements

SERVICE NOTATION	TYPE OF SURVEY		
	CLASS RENEWAL	INTERMEDIATE	ANNUAL
liquefied gas carrier	Ch 4, Sec 5, [6.2], Ch 4, Sec 5, [6.3.2] and Ch 4, Sec 5, [6.5]: planning and general requirements Ch 4, Sec 5, Tab 2: measurements of elements subjected to close-up survey Ch 4, Sec 5, Tab 3: extent of systematic thickness measurements Where substantial corrosion is found, the extent of thickness measurements may be increased to the Surveyor's satisfaction, using Ch 3, Sec 3, Tab 4 as guidance	Ch 4, Sec 5, Tab 1: thickness measurements to be taken if deemed necessary by the Surveyor Where substantial corrosion is found, the extent of thickness measurements may be increased to the Surveyor's satisfaction, using Ch 3, Sec 3, Tab 4 as guidance	Ch 4, Sec 5, [2.5.2] limited to ballast tanks and when deemed necessary by the Surveyor Where substantial corrosion is found, the extent of thickness measurements may be increased to the Surveyor's satisfaction, using Ch 3, Sec 3, Tab 4 as guidance
general cargo ship	Ch 4, Sec 7, [4.1], Ch 4, Sec 7, [4.2] and Ch 4, Sec 7, [4.5]: planning and general requirements Ch 4, Sec 7, Tab 4: measurements of elements subjected to close-up survey Ch 4, Sec 7, Tab 5: extent of systematic thickness measurements Where substantial corrosion is found, the extent of thickness measurements may be increased to the Surveyor's satisfaction, using Ch 4, Sec 7, Tab 6 as guidance	• Ships 15 years of age or less: Ch 4, Sec 7, Tab 2 for cargo holds Ch 4, Sec 7, Tab 3 for ballast tanks Ch 4, Sec 7, Tab 6, where substantial corrosion is found • Ships over 15 years of age: see references given for class renewal survey	Ch 4, Sec 7, Tab 1 for cargo holds when deemed necessary by the Surveyor or where extensive corrosion exists Ch 4, Sec 7, [2.4] for ballast tanks when deemed necessary by the Surveyor or where extensive corrosion exists Ch 4, Sec 7, Tab 6 where substantial corrosion is found

Ch 3, Sec 1, [3.1]

Delete requirement [3.1.6].

Ch 3, Sec 2, [2.1]

Replace requirement [2.1.1] by:

2.1.1 The requirements given in Tab 1 for the survey and testing of ballast tanks, cargo holds (for dry cargo ships to which the additional requirements in Ch 4, Sec 2 and Ch 4, Sec 7 do not apply) and cargo tanks (for non-ESP tankers) are to be complied with.

Ch 3, Sec 2, Tab 1

Replace the row "SALT WATER BALLAST SPACES".

*Replace Table footnotes **(2)** and **(3)**.*

Table 1 : Intermediate survey of hull (all ships)

ITEM	Age of ship (in years at time of intermediate survey)		
	5 < age ≤ 10	10 < age ≤ 15	age > 15
BALLAST TANKS	Representative ballast tanks internally examined Thickness measurements, if considered necessary by the Surveyor See **(1) (2) (3)**	All ballast tanks internally examined Thickness measurements, if considered necessary by the Surveyor See **(1) (3)**	All ballast tanks internally examined Thickness measurements, if considered necessary by the Surveyor Tightness of inner bottom plating of cargo holds in way of double bottom ballast tanks checked, if considered necessary by the Surveyor See **(1) (3)**

(2) If there is no hard protective coating, soft or semi-hard coating or poor coating condition, the examination is to be extended to other ballast tanks of the same type.

(3) For ballast tanks, excluding double bottom ballast tanks, if there is no hard protective coating, soft or semi-hard coating or poor coating condition and it is not renewed, the tanks in question are to be internally examined at annual intervals.

When such conditions are found in double bottom ballast tanks, the tanks in question may be examined at annual intervals.

Ch 3, Sec 3, Table 2

Replace the second row "Salt water ballast tanks (all types)" by:

Table 2 : Requirements for internal examination of integral (structural) tanks at class renewal survey

Tank	Age of ship (in years at time of class renewal survey)			
	Class renewal survey No.1 age ≤ 5	Class renewal survey No.2 5 < age ≤ 10	Class renewal survey No.3 10 < age ≤15	Class renewal survey No.4 and subsequent age > 15
Ballast tanks (all types)	all	all	all	all

Ch 3, Sec 4, [3.1]

Replace requirement [3.1.2] as follows:

3.1.2 In principle, no outstanding conditions of class are to exist requiring repair work to be carried out to the underwater part of the shell plating, the rudder, the propeller or the propeller shaft, unless the Society is satisfied that such repairs may be carried out while the ship is afloat.

Ch 3, App 1, [5.3.2]

Replace the last bullet of the bulleted list by the following one:

- dealing with the conditions of class due at the date of recommissioning or which became due during the lay-up period.

Ch 4, Sec 2, [2.3]

Delete requirement [2.3.2].

Ch 4, Sec 5, [4]

Replace Sub-article title [4.3] by:

4.3 Ballast tanks

Ch 4, Sec 5, [4.3]

Replace requirement [4.3.1] as follows:

4.3.1 The requirements for survey of ballast tanks given in Tab 1 are to be complied with.

Ch 4, Sec 5

Replace Table 1 by:

Table 1 : Intermediate survey of ballast tanks for liquefied gas carriers

Age of ship (in years at time of intermediate survey)		
5 < age ≤ 10	10 < age ≤ 15	age > 15
Overall survey of representative ballast tanks, selected by the attending Surveyor See **(1)**, **(2)** and **(3)**	Overall survey of all ballast tanks See **(1)** and **(3)**	Overall survey of all ballast tanks See **(1)** and **(3)**
	Close-up survey of: - all web frames and both transverse bulkheads in a representative ballast tank **(4)** and **(5)** - the upper part of one web frame in another representative ballast tank - one transverse bulkhead in another representative ballast tank **(5)** See **(6)**, **(7)** and **(8)**	Close-up survey of all web frames and both transverse bulkheads in two representative ballast tanks **(4)** and **(5)** See **(6)**, **(7)** and **(8)**

(1) If such surveys reveal no visible structural defects, the examination may be limited to a verification that the corrosion prevention system remains efficient.

(2) If there is no hard protective coating, soft or semi-hard coating or poor coating condition, the examination is to be extended to other ballast tanks of the same type.

(3) For ballast tanks, excluding double bottom tanks, if there is no hard protective coating, soft or semi-hard coating, or poor coating condition and it is not renewed, the tanks in question are to be internally examined at annual intervals.
When such conditions are found in double bottom ballast tanks, the tanks in question may be internally examined at annual intervals.

(4) Complete transverse web frame including adjacent structural members.

(5) Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure.

(6) The extent of close-up surveys may be extended in accordance with the requirements of [6.4.3].

(7) For areas in ballast tanks where protective coating is found to be in good condition, as defined in Ch 2, Sec 2, [2.2.14], the extent of close-up survey may be specially considered.

(8) Ballast tanks include topside, double hull side, double bottom, hopper side, or any combined arrangement of the aforementioned, and peak tanks where fitted.

Replace Table title of Table 2 as follows:

Table 2 : Requirements for close-up survey of ballast tanks at class renewal survey of liquefied gas carriers

Ch 4, Sec 5, [6.3]

Replace requirement [6.3.7] as follows:

6.3.7 Where provided, the condition of the corrosion prevention system of ballast tanks is to be examined.

For ballast tanks, excluding double bottom tanks, where a hard protective coating is found in poor condition and it is not renewed, where soft or semi-hard coating has been applied, or where a hard protective coating was not applied from time of construction, the tanks in question are to be examined at annual intervals. Thickness measurements are to be carried out as deemed necessary by the Surveyor.

When such breakdown of hard protective coating is found in double bottom ballast tanks and it is not renewed, where a soft or semi-hard coating has been applied, or where a hard protective coating was not applied from the time of construction, the tanks in question may be examined at annual intervals. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out.

Ch 4, Sec 5, [6.4]

Replace requirement [6.4.2] as follows:

6.4.2 Each class renewal survey is to include a close-up examination of sufficient extent to establish the condition of cargo tanks and ballast tanks. The minimum requirements for close-up surveys are given in Tab 2 for ballast tanks and in [6.7.3] for cargo tanks.

Ch 4, Sec 5, [6.4.4]

Replace the second paragraph by the following one:

For ships having independent tanks of type C, with a midship section similar to that of a general cargo ship, the extent of close-up surveys of ballast tanks may be specially considered by the Society.

Ch 4, Sec 5, [6.6]

Replace requirement [6.6.1] as follows:

6.6.1 All boundaries of ballast tanks and deep tanks used for water ballast within the cargo area are to be pressure tested. For fuel oil tanks, the representative tanks are to be pressure tested.

Ch 4, Sec 7, [1.1.1]

Replace the second paragraph by:

The requirements of this Section do not apply to general dry cargo ships of double side-skin construction, with double side-skin extending for the length of the cargo area, and over the height of the cargo hold to the upper deck.

Note 1: Special consideration may also be given to ships that are of double-skin construction but with single skin in way of several frame spaces, e.g. in way of a cargo hold entrance or in way of forebody hull form at the forward end of the foremost cargo hold.

Ch 4, Sec 7, [3.2]

Replace requirement [3.2.2] as follows:

3.2.2 The requirements for survey of ballast tanks given in Tab 3 are to be complied with.

Ch 4, Sec 7, [4.2]

Replace requirement [4.2.3] as follows:

4.2.3 All cargo holds, ballast tanks, including double bottom tanks, pipe tunnels, cofferdams and void spaces bounding cargo holds, decks and outer hull are to be examined, and this examination is to be supplemented by thickness measurement and testing as required in [4.5] and [4.6] to ensure that the structural integrity remains effective. The aim of the examination is to discover substantial corrosion, significant deformation, fractures, damages or other structural deformation, that may be present.

Replace requirements [4.2.6] to [4.2.8] as follows:

4.2.6 As indicated in Ch 3, Sec 3, [2.1.1], a bottom survey in dry condition is to be a part of the class renewal survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and ballast tanks are to be carried out in accordance with the applicable requirements for class renewal surveys, if not already performed.

Lower portions of the cargo holds and ballast tanks are considered to be the parts below light ballast water line.

4.2.7 Where provided, the condition of the corrosion prevention system of ballast tanks is to be examined.

For ballast tanks, excluding double bottom tanks, where a hard protective coating is found in poor condition and it is not renewed, where soft or semi-hard coating has been applied, or where a hard protective coating was not applied from time of construction, the tanks in question are to be examined at annual intervals. Thickness measurements are to be carried out as found necessary by the Surveyor.

When such breakdown of hard protective coating is found in double bottom ballast tanks and it is not renewed, where a soft or semi-hard coating has been applied, or where a hard protective coating was not applied from the time of construction, the tanks in question may be examined at annual intervals. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out.

4.2.8 Where the hard protective coating in tanks is found to be in good condition, the extent of close-up surveys and thickness measurements may be specially considered.

Ch 4, Sec 7

Replace Table 3 and Table 4 by:

Table 3 : Intermediate survey of ballast tanks for general cargo ships

Age of ship (in years at time of intermediate survey)	
5 < age ≤ 10	10 < age ≤ 15
Overall survey of representative ballast tanks selected by the Surveyor See **(1)**, **(2)** and **(3)**	Overall survey of all ballast tanks See **(1)** and **(3)**
Areas found suspect at the previous surveys are to be surveyed in accordance with the provisions indicated in [2.1.1]	Areas found suspect at the previous surveys are to be surveyed in accordance with the provisions indicated in [2.1.1]

(1) If such overall survey reveals no visible structural defects, the examination may be limited to a verification that the corrosion prevention system remains efficient.

(2) Where poor coating condition, soft or semi-hard coating, corrosion or other defects are found in ballast tanks or where a hard protective coating was not applied from the time of construction, the examination is to be extended to other ballast tanks of the same type.

(3) In ballast tanks other than double bottom tanks, where a hard protective coating is found in poor condition and it is not renewed, where a soft or semi-hard coating has been applied or where a hard protective coating was not applied from time of construction, the tanks in question are to be examined and thickness measurements carried out as considered necessary at annual surveys.

When such breakdown of hard protective coating is found in double bottom ballast tanks, where a soft or semi-hard coating has been applied or where a hard protective coating has not been applied, the tanks in question may be examined at annual surveys. When considered necessary by the Surveyor or where extensive corrosion exists, thickness measurements are to be carried out.

Table 4 : Requirements for close-up survey at class renewal survey of general cargo ships

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age ≤ 5	Class renewal survey No.2 5 < age ≤ 10	Class renewal survey No.3 10 < age ≤ 15	Class renewal survey No.4 and subsequent age > 15
Selected shell frames in one forward and one aft cargo hold and associated 'tweendeck spaces ①	Selected shell frames in all cargo holds and 'tweendeck spaces ①	All shell frames in the forward lower cargo hold and 25% of shell frames in each of the remaining cargo holds and 'tweendeck spaces including upper and lower end attachments and adjacent shell plating ①	All shell frames in all cargo holds and 'tweendeck spaces including upper and lower end attachments and adjacent shell plating ①
One selected cargo hold transverse bulkhead ②	One transverse bulkhead in each cargo hold ② Forward and aft transverse bulkheads in one side ballast tank, including stiffening system ②	All cargo hold transverse bulkheads ② All transverse bulkheads in ballast tanks, including stiffening system ②	Areas ② to ⑥ as for class renewal survey for ships between 10 and 15 years of age
	One transverse web with associated plating and framing in two representative ballast tanks of each type (i.e. topside, hopper side, side tank or double bottom tank) ③	All transverse webs with associated plating and framing in each ballast tank ③	
All cargo hold hatch covers and coamings (plating and stiffeners) ④	All cargo hold hatch covers and coamings (plating and stiffeners) ④	All cargo hold hatch covers and coamings (plating and stiffeners) ④	
	Selected areas of all deck plating and underdeck structure inside line of hatch openings between cargo hold hatches ⑤	All deck plating and underdeck structure inside line of hatch openings between cargo hold hatches ⑤	
	Selected areas of inner bottom plating ⑥	All areas of inner bottom plating ⑥	

Note 1: See Fig 1, Fig 2, Fig 3 and Fig 4 for areas ①, ②, ③, ④, ⑤ and ⑥.

① Cargo hold transverse frames.

② Cargo hold transverse bulkhead plating, stiffeners and girders.

③ Transverse web frame or watertight transverse bulkhead in ballast tanks.

④ Cargo hold hatch covers and coamings. Subject to cargo hold hatch covers of approved design which structurally have no access to the internals, close-up survey/thickness measurement is to be done of the accessible parts of hatch cover structures.

⑤ Deck plating and underdeck structure inside line of hatch openings between cargo hold hatches.

⑥ Inner bottom plating.

Note 2: Close-up survey of cargo hold transverse bulkheads to be carried out at the following levels:

- immediately above the inner bottom and immediately above the 'tweendecks, as applicable
- mid-height of the bulkheads for holds without 'tweendecks
- immediately below the main deck plating and 'tweendeck plating.

Ch 4, Sec 7, [4.6]

Replace requirement [4.6.1] as follows:

4.6.1 All boundaries of ballast tanks and deep tanks used for water ballast within the cargo length area are to be pressure tested. For fuel oil tanks, the representative tanks are to be pressure tested.

Ch 4, Sec 8, [6.2]

Add the following new requirement [6.2.4]:

6.2.4 For ships granted with the additional service feature **standardized design bollard pull = [T_{BP}/9,81] t**, the survey is to include a new bollard pull test as defined in Pt E, Ch 1, App 1, [9].

Ch 4, Sec 9, [5.5.2]

Replace the second bullet of the bulleted list by the following one:

- vacuum insulated independent fuel storage tanks of type C without access openings need not be examined internally. Where fitted, the vacuum monitoring system shall be examined and records should be reviewed.

Ch 5, Sec 2, [3.3]

Replace requirements [3.3.1] and [3.3.2] as follows:

3.3.1 The maintenance of the **STAR-HULL** notation is subject to the same principles as those for the maintenance of class: surveys are to be carried out by their limit dates and possible conditions of class (related to the notation) are to be dealt with by their limit dates.

The suspension of class automatically causes the suspension of the **STAR-HULL** notation.

3.3.2 Various events may lead either to imposition of a condition of class related to the **STAR-HULL** notation or to suspension of the notation itself. Some cases are given below:

- The condition of the ship is below the minimum level required for class (e.g. scantling of a hull structure below the corrosion margin). The action to be taken is either the immediate repair or the imposition of a condition of class for the class (if acceptable) and suspension of the **STAR-HULL** notation. However, in cases where the condition of class is of a minor nature, the notation may not be suspended.
- The condition of the ship is below the minimum level for the **STAR-HULL** notation, but still above the level for the class (e.g. the scantling of a hull structure is below the corrosion margin acceptable for the notation but is still above the corrosion margin). The action to be taken is either the immediate repair or the imposition of a condition of class for the **STAR-HULL** notation (without condition of class for class).
- The Inspection and Maintenance Plan is not complied with (e.g. delays in performing the operations programmed according to the plan or the scope of inspection and/or maintenance not completely fulfilled).

  The action to be taken is:
  - either the immediate compliance with the requirements or the imposition of a condition of class if the non-conformity is of a minor nature or is an exceptional occurrence
  - or the suspension of the **STAR-HULL** notation if the non-conformity is of a major nature or a recurrence.
- A defect or a deficiency is found in applying the IMP. The actions to be taken are the same as stated both for repair of structure/coating/equipment (first two cases above) and for the application of the IMP (third case above).
- An unexpected defect or deficiency is found or an accident occurs, i.e. not as a result of lack of maintenance or failure in the application of the IMP. The actions to be taken are the same as stated for repair of structure/coating/equipment (first two cases above).

Ch 5, Sec 7, [3.3]

Replace requirement [3.3.1] by:

3.3.1 At each annual and class renewal survey, the following is to be checked:

- proper operation of the NOx Control Diagnostic (NCD) and Particulate Control Diagnostic (PCD) systems, when fitted
- proper operation of the recording of the status of the engines related to the operations in the ULEV mode
- confirmation that no modification has been carried out without prior approval of the Society on the engines covered by the **ULEV** additional class notation. In case of replacement or modification of an engine, testing as per Pt F, Ch 11, Sec 26 may be required unless otherwise duly justified and documented by the engine's manufacturer.

Ch 5, Sec 7, [3]

Replace Sub-article [3.4] as follows:

3.4 Continuous emission monitoring system (CEMS)

3.4.1 At each annual and class renewal survey, the following is to be checked:

- confirmation that the waste discharge and air emission parameters required to be monitored and recorded are transmitted on a regular basis via a satellite communication system to a shipowner facility ashore
- confirmation that such information is made available to the Surveyor upon request.

Ch 5, Sec 10, [5.1.2]

Replace the 7th bullet of the bulleted list by the following one:

- for ships granted with the additional class notation **DYNAPOS AM/AT-R** or **DYNAPOS AM/AT-RS**, test of all important systems and components to document the ability of the DP vessel to keep position after single failures associated with the assigned equipment class and to validate the FMEA and operations manual. As a minimum, there should be tests of the failures of position and environmental reference systems, thrusters, power generation and distribution systems, position controls and UPS's. Such tests are to be carried out at sea with the DP system in running condition. The results of these tests are to be recorded and kept on board.

  Note 1:For ships granted with the **- DDPS** notation, reference is made to Ch 1, Sec 2, [6.14.6] and Pt F, Ch 11, Sec 6, [11]: tests to be carried out at sea may be performed by ship's crew without attendance of a Surveyor and will be reviewed digitally by a Surveyor.

Ch 6, Sec 2, [1.1]

Delete requirement [1.1.3].

Ch 6, Sec 2, [1]

Delete Sub-article [1.6].

Amendments to PART B

Ch 1, Sec 2, [2.1.1]

Replace the definition of "T" as follows:

T : Scantling draught, in m, defined in [3.7]

Ch 1, Sec 2, [3.1]

Replace requirements [3.1.1] and [3.1.2] as follows:

3.1.1 The rule length L is the distance, in m, measured on the waterline at the scantling draught, from the fore-side of the stem to the after side of the rudder post, or to the centre of the rudder stock where there is no rudder post. L is to be not less than 96% and need not exceed 97% of the extreme length on the waterline at the scantling draught.

3.1.2 In ships without rudder stock (e.g. ships fitted with azimuth thrusters), the rule length L is to be taken equal to 97% of the extreme length on the waterline at the scantling draught.

Ch 1, Sec 2, [3.4]

Replace requirement [3.4.1] as follows:

3.4.1 The moulded breadth B is the greatest moulded breadth, in m, measured amidships at the scantling draught T.

Ch 1, Sec 2, [3]

Replace Sub-article [3.7] as follows:

3.7 Scantling draught

3.7.1 The scantling draught T is the distance, in m, measured vertically on the midship transverse section, from the moulded base line to the waterline at which the strength requirements for the scantlings of the ships are met. It represents the full load condition and is to be not less than that corresponding the assigned freeboard.

In the case of ships with a solid bar keel, the moulded base line is to be taken as defined in [3.5.1].

Ch 4, Sec 3, [4.4.3]

Replace the second paragraph by:

For a ring system, where the end bracket is integral with the web of the two connected members and the face plate runs continuously on the bracket from the web of one member to the other, the full cross section of the larger face plate of the two members is to be maintained close to the mid-point of the bracket and gradually tapered to the smaller face plate. Butts in face plates are to be kept well clear of the bracket toes.

Ch 4, Sec 6, [4.2.1]

Replace the second paragraph by:

Insert plates may be replaced by doubling plates, except in the case of pillars which may also work under tension such as those in tanks. In such case, the insert plates are to comply with the requirements in Ch 4, Sec 1, [2.7] in order to prevent laminar tearing.

Ch 9, Sec 1, [5.1.4]

Delete the definition of "d_1".

Ch 9, Sec 1, Table 7

Replace Table title by:

Table 7: Thickness of the vertical webs and rudder side plating welded to solid part or to rudder coupling flange

Ch 9, Sec 1, [7.3.2]

Replace the last paragraph by:

Where the rudder is connected to the rudder stock with a coupling flange, the thickness of the top plate which is welded in extension of the rudder coupling flange is to be not less than 1,1 times the thickness calculated above.

Ch 9, Sec 1, [7.3]

Replace requirement [7.3.5] as follows:

7.3.5 Thickness of side plating and vertical web plates welded to solid part or to rudder coupling flange

The thickness, in mm, of the vertical web plates welded to the solid part where the rudder stock is housed, or welded to the rudder coupling flange, as well as the thickness of the rudder side plating under this solid part, or under the rudder coupling flange, is to be not less than the value obtained, in mm, from Tab 7.

Ch 9, Sec 1, [7.5.2]

Replace the second and the third paragraphs by:

For the calculation of this actual section modulus, the length of the rudder cross-section equal to the length of the rudder coupling flange is to be considered.

Where the rudder plating is provided with an opening under the rudder coupling flange, the actual section modulus of the rudder blade is to be calculated in compliance with [7.4.3].

Ch 9, Sec 1, [7.5.3]

Replace the third and fourth paragraphs by:

The external fillet welds between the rudder blade plating and the rudder coupling flange are to be of concave shape and their throat thickness is to be at least equal to 0,5 times the rudder blade thickness.

Moreover, the rudder coupling flange is to be checked before welding by non-destructive inspection for lamination and inclusion detection in order to reduce the risk of lamellar tearing.

Ch 9, Sec 1, [7.5]

Replace requirement [7.5.4] as follows:

7.5.4 Thickness of side plating and vertical web plates welded to the rudder coupling flange

The thickness of the vertical web plates directly welded to the rudder coupling flange as well as the plating thickness of the rudder blade upper strake in the area of the connection with the rudder coupling flange are to be not less than the values obtained, in mm, from Tab 7.

Ch 9, App 2, [2.5.3]

Replace the definition "K" as follows:

K : Coefficient to be taken equal to:

- for polyamide lines:

  K = 1,2

- for lines made in other synthetic material:

  K = 1,1

Ch 11, Sec 1, [1.4]

Replace requirement [1.4.4] as follows:

1.4.4 Non-destructive testing operators

Non-destructive tests are to be carried out by qualified personnel, certified by recognised bodies in compliance with appropriate standards. The qualifications are to be appropriate to the specific applications.

In case of non-destructive testing carried out by an independent company from the manufacturer or shipyard, qualification of operators has to comply with the requirements set out in NR669 "Recognition of non-destructive testing suppliers".

Ch 11, Sec 1, [6.2]

Insert the following new requirement [6.2.2]:

6.2.2 In case of non-destructive testing carried out by an independent company from the manufacturer or shipyard, such company has to comply with the requirements set out in NR669 "Recognition of non-destructive testing suppliers".

Amendments to PART C

CHAPTER 1 - MACHINERY

Ch 1, Sec 1, [1.4]

Delete requirements [1.4.1] and [1.4.2].

Ch 1, Sec 1, [2.2]

Add the following new requirement [2.2.3]:

2.2.3 Non-destructive testing suppliers

In case of non-destructive testing carried out by an independent company from the manufacturer or shipyard, such company has to comply with the requirements set out in NR669 Recognition of non-destructive testing suppliers.

Ch 1, Sec 2, [4.1.4]

Replace the second paragraph of item e) as follows:

Propulsion engines for ships having the service notation **HSC-CAT A**, **HSC-CAT B**, **HSC**, **high speed craft** or **light ship**, high speed craft or light ship that may be used for frequent load changes from idle to full are normally to be tested with at least 500 cycles (idle - full load - idle) using the steepest load ramp that the control system (or operation manual if not automatically controlled) permits. The duration at each end is to be sufficient for reaching stable temperatures of the hot parts

Ch 1, Sec 2, Table 8

Replace "safety valves" by "explosion relief valves" in Table footnote (6).

Ch 1, Sec 9, [3.3.3]

Add the following new item c) in the alphanumeric list:

c) The generating set is to show torsional vibration levels which are compatible with the allowable limits for the alternator, shafts, coupling and damper.

Ch 1, Sec 9, [3.5.3]

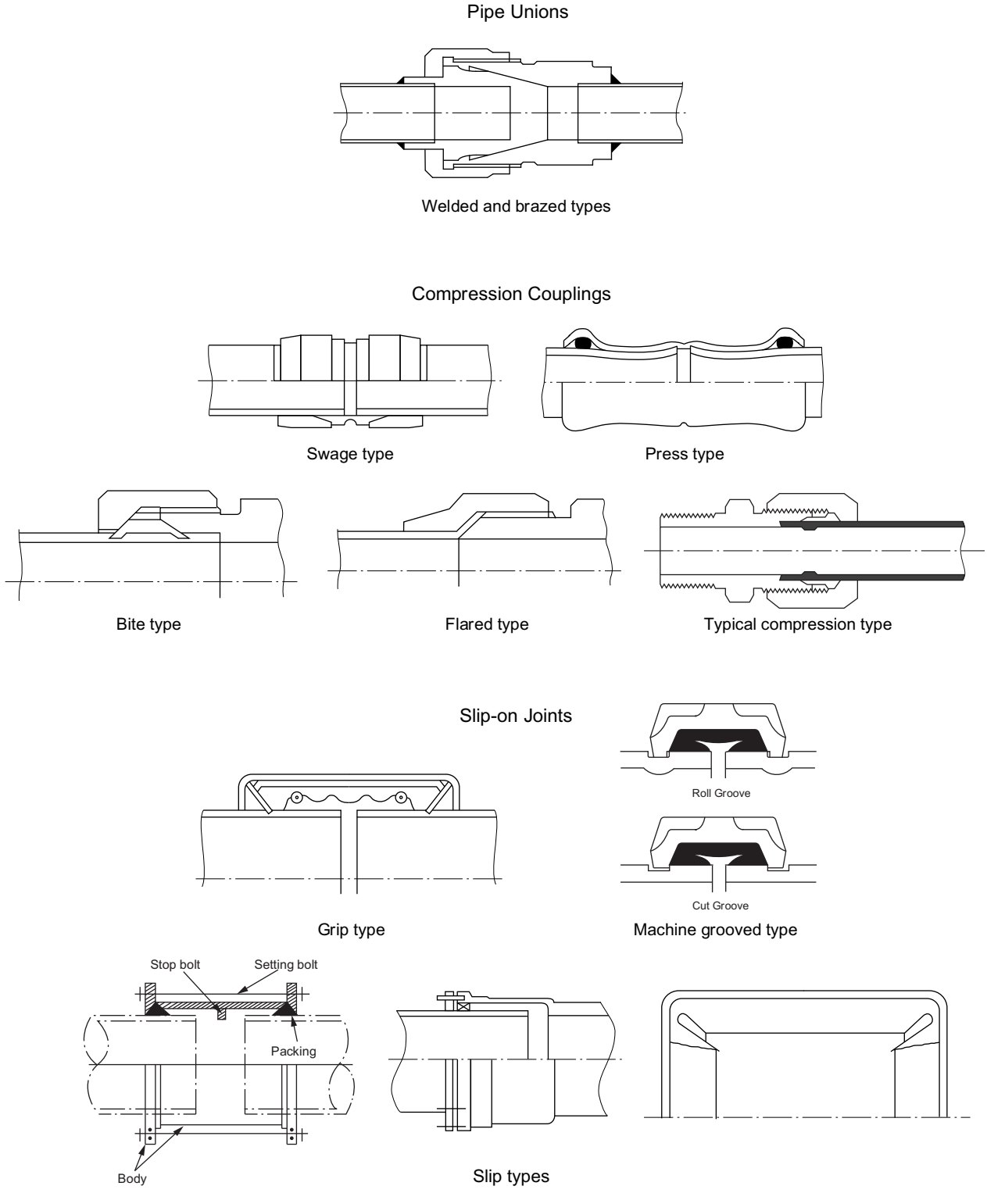
Insert the following new item b) in the alphanumeric list:

b) The coupling selection for the generating set is to take into account the stresses and torques imposed on it by the torsional vibration of the system.

Ch 1, Sec 10

Replace Figure 2 by the following one:

Figure 2 : Examples of mechanical joints



Ch 1, Sec 10, Table 5

Replace in the fourth column, "Not to be used for boiler blow-down valves and pieces for connection to the shell plating" by "Not to be used for boiler blow-down valves not for associated pieces for connection to the shell plating".

Ch 1, Sec 10, [20.4.2]

Replace "ISOISO" by "ISO" at the end of item c).

Ch 1, Sec 10, Table 41

In the third row "Pipes, valves and fittings connected...", replace the reference to "[20.4.3], b)" by the reference to "[20.5.3], b)".

Ch 1, Sec 11, [4.1]

Delete requirement [4.1.2].

Ch 1, Sec 11, [4]

Replace Sub-article [4.2] by:

4.2 Steering arrangements

4.2.1 General

The requirements in this sub-article apply to ships fitted with alternative propulsion and steering arrangements, such as but not limited to, azimuthing propulsors or water jet propulsion systems.

4.2.2 Steering arrangements for ships fitted with multiple steering-propulsion units

For a ship fitted with multiple steering-propulsion units, such as, but not limited to, azimuthing propulsors or water jet propulsion systems, each of the steering-propulsion units is to be provided with a main steering gear and an auxiliary steering gear or with two or more identical steering actuating systems in compliance with [4.2.7]. The main steering gear and the auxiliary steering gear are to be so arranged that the failure of one of them will not render the other one inoperative.

4.2.3 Steering arrangements for ships fitted with single steering-propulsion unit

For a ship fitted with a single steering-propulsion unit, the steering gear is to be provided with two or more steering actuating systems complying with [4.2.7]. A detailed risk assessment is to be submitted in order to demonstrate that in the case of any single failure in the steering gear, control system and power supply, the ship steering is maintained.

4.2.4 Design of components used in steering arrangements

All components used in steering arrangements for ship directional control are to be of sound reliable construction to the satisfaction of the Administration or recognized organizations acting on its behalf. Special consideration should be given to the suitability of any essential component which is not duplicated. Any such essential component is, where appropriate, to utilize anti-friction bearings such as ball bearings, roller bearings or sleeve bearings which should be permanently lubricated or provided with lubrication fittings.

4.2.5 Main steering arrangements

The main steering arrangements for ship directional control are to be:

- of adequate strength and capable of steering the ship at maximum ahead service speed which should be demonstrated
- capable of changing direction of the steering-propulsion unit from one side to the other at declared steering angle limits at an average turning speed of not less than 2,3°/s with the ship running ahead at maximum ahead service speed
- for all ships, operated by power; and
- so designed that they will not be damaged at maximum astern speed; this design requirement need not be proved by trials at maximum astern speed and declared steering angle limits.

Note 1: Declared steering angle limits are the operational limits in terms of maximum steering angle, or equivalent, according to manufacturers' guidelines for safe operation, also taking into account the ship's speed or propeller torque/speed or other limitation; the "declared steering angle limits" are to be declared by the directional control system manufacturer for each ship specific non-traditional steering mean.

Note 2: Ship manoeuvrability tests, such as those in the Standards for ship manoeuvrability (IMO Resolution MSC.137(76)) should be carried out with steering angles not exceeding the declared steering angle limits.

4.2.6 Auxiliary steering arrangements

The auxiliary steering arrangements for ship directional control are to be:

- of adequate strength and capable of steering the ship at navigable speed and of being brought speedily into action in an emergency
- capable of changing direction of the ship's directional control system from one side to the other at declared steering angle limits at an average turning speed, of not less than 0.5°/s; with the ship running ahead at one half of the maximum ahead service speed or 7 knots, whichever is the greater; and
- for all ships, operated by power where necessary to meet the requirements of SOLAS regulation II-1/29.4.2 and in any ship having power of more than 2,500 kW propulsion power per steering-propulsion unit.

Note 1: The definition of "declared steering angle limits", set out in [4.2.5] above, applies.

Note 2: Ship manoeuvrability tests, such as those in the Standards for ship manoeuvrability (IMO Resolution MSC.137(76)) should be carried out with steering angles not exceeding the declared steering angle limits.

4.2.7 Omission of the auxiliary steering gear

a) For a ship fitted with a single steering-propulsion unit where the main steering gear comprises two or more identical power units and two or more identical steering actuators, an auxiliary steering gear need not be fitted provided that the steering gear:
   - in a passenger ship, is capable of satisfying the requirements in [4.2.5] while any one of the power units is out of operation
   - in a cargo ship, is capable of satisfying the requirements in [4.2.5] while operating with all power units; and
   - is arranged so that after a single failure in its piping system or in one of the power units, steering capability can be maintained or speedily regained.

b) For a ship fitted with multiple steering-propulsion units, where each main steering system comprises two or more identical steering actuating systems, an auxiliary steering gear need not be fitted provided that each steering gear:
   - in a passenger ship, is capable of satisfying the requirements in [4.2.5] while any one of the steering gear steering actuating systems is out of operation
   - in a cargo ship, is capable of satisfying the requirements in [4.2.5] while operating with all steering gear steering actuating systems
   - is arranged so that after a single failure in its piping or in one of the steering actuating systems, steering capability can be maintained or speedily regained; and
   - the above capacity requirements apply regardless whether the steering systems are arranged with common or dedicated power units.

Note 1: For the purposes of alternative steering arrangements, the steering gear power unit should be considered as defined in [1.3.4]. For electric steering gears, refer to [1.3.4]; electric steering motors should be considered as part of the power unit and actuator.

4.2.8 Case of the steering-propulsion units having a residual steering capability when propulsion power is lost

This requirement applies to steering-propulsion units having a certain proven steering capability due to ship speed also in case propulsion power has failed.

Where the propulsion power exceeds 2,500 kW per thruster unit, an alternative power supply, sufficient at least to supply the steering arrangements which complies with the requirements of [2.2.2], item b), and also its associated control system and the steering gear response indicator, is to be provided automatically, within 45 s, either from the emergency source of electrical power or from an independent source of power located in the steering gear compartment. This independent source of power is to be used only for this purpose. In every ship of 10,000 gross tonnage and upwards, the alternative power supply is to have a capacity for at least 30 min of continuous operation and in any other ship for at least 10 min.

4.2.9 Additional requirement for ships fitted with multiple electric or electrohydraulic steering systems

For a ship fitted with multiple electric or electrohydraulic steering systems, the requirements of [2.7.2], items a), b) and c), are to be applied to each of the steering systems.

Ch 1, Sec 12, [2.2]

Delete requirement [2.2.7].

Ch 1, Sec 15, [3.3.2]

Replace item b) by the following one:

b) The stopping times, ship headings and distances recorded on trials, together with the results of trials to determine the ability of ships having multiple propellers or propulsion/steering systems to navigate and manoeuvre with one or more propellers or propulsion/steering systems inoperative, shall be available on board for the use of the Master or designated personnel

Ch 1, App 3, Table 1

Replace the reference to "Ch 1, Sec 1, [1.4.1]" by the reference to "Ch 4, Sec 1, [3.24.1]" in Table footnote (14).

CHAPTER 2 - ELECTRICITY

Ch 2, Sec 4, [2.3]

Add the following new requirements [2.3.4] and [2.3.5]:

2.3.4 The rated power of the generating set is to be appropriate for its actual use. See also Ch 1, Sec 2, [1.3.2].

2.3.5 The entity responsible of assembling the generating set is to install a rating plate marked with at least the following information:

a) the generating set manufacturer's name or mark

b) the set serial number

c) the set date of manufacture (month/year)

d) the rated power (both in kW and KVA) with one of the prefixes COP, PRP (or, only for emergency generating sets, LTP) as defined in ISO 8528-1:2018

e) the rated power factor

f) the set rated frequency, in Hz

g) the set rated voltage, in V

h) the set rated current, in A

i) the mass, in kg.

Ch 2, Sec 7, [1.4]

Replace requirement [1.4.1] as follows:

1.4.1 For Li Ion batteries used as emergency source or transitional source or of capacity above 20kWh, the requirements specified in the additional notation **BATTERY SYSTEM** in Part F, Ch 11, Sec 21 [5] apply.

For Li Ion batteries of capacity above 20kWh, the requirements specified in the additional notation **BATTERY SYSTEM** in Part F, Ch 11, Sec 21 [3] apply.

CHAPTER 3 - AUTOMATION

Ch 3, Sec 6, Table 1

In row "14" column "Test", replace "Radiated radio frequency" by "Electromagnetic field".

Ch 3, Sec 6, Table 2

In row "14", column "Test", replace "Radiated radio frequency" by "Electromagnetic field".

In row "19", column "Other information", replace "shall" by "is to".

CHAPTER 4 - FIRE SAFETY

Ch 4, Sec 1, [2.5.1]

Insert the following new items b), c), d) and e):

b) C-class divisions

c) Prefabricated sanitary units

d) Prefabricated window casings

e) Fire door control systems

Ch 4, Sec 1, [3]

Insert the following new Sub-article [3.38]:

3.38 Semi-enclosed space

3.38.1 A semi-enclosed space is a space limited by decks and/or bulkheads in such a manner that the natural conditions of ventilation in the space are notably different from those obtained on open deck.

Ch 4, Sec 5, [1.3.3]

In item b), 2), add the following paragraph at the end of the 10th bullet of the bulleted list:

Spaces dedicated to urea or sodium hydroxide solution tanks for selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) systems or exhaust gas cleaning systems (EGCS), when separated from the engine room.

Ch 4, Sec 5, [1.3.4]

In item b), 2), add the following paragraph at the end of the 7th bullet of the bulleted list:

Spaces dedicated to urea or sodium hydroxide solution tanks for selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) systems or exhaust gas cleaning systems (EGCS), when separated from the engine room.

Ch 4, Sec 5, [1.4.3]

In item b), 2), add the following paragraph at the end of the 7th bullet of the bulleted list:

Spaces dedicated to urea or sodium hydroxide solution tanks for selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) systems or exhaust gas cleaning systems (EGCS), when separated from the engine room.

Ch 4, Sec 5, [1.5.2]

In item b), 2), add the following paragraph at the end of the 7th bullet of the bulleted list:

Spaces dedicated to urea or sodium hydroxide solution tanks for selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) systems or exhaust gas cleaning systems (EGCS), when separated from the engine room.

Ch 4, Sec 6, [1.3.4]

Insert the following new item b) in the alphanumeric list:

b) When the main water supply for other fixed fire-extinguishing systems is from the fire pumps, the total capacity of the fire pumps is to be sufficient for the simultaneous use of:

- the two jets of water required in [1.2.5] item a), and
- other fixed fire-extinguishing systems primarily fed by the fire main, or likely combination thereof.

Ch 4, Sec 11, [3.2.1]

Replace the second bullet of the bulleted list by the following one:

- the requirements of [3.2.7] and [3.2.8] when located on the open deck.

Ch 4, Sec 11, [3.2.5]

Add the following paragraph at the end of the requirement:

The boundaries between storage holds and other category A machinery spaces are to have A-60 fire integrity and the boundaries between storage holds for different fuels are to have A-30 fire integrity.

Ch 4, Sec 11, [3.2.8]

Replace the second paragraph by the following one:

In addition, fuel tanks are to be segregated from cargo in accordance with the requirements of the International Maritime Dangerous Goods (IMDG) Code where the fuel tanks are regarded as a class 2.1 bulk package.

Ch 4, Sec 11 [3.8]

Delete requirement [3.8.3]

Ch 4, Sec 11, [4.4]

Insert the following requirement [4.4.2]:

4.4.2 Ventilation

Enclosed hangar facilities or enclosed spaces containing refuelling installations are to be provided with mechanical ventilation as required by Ch 4, Sec 13, [2] for closed ro-ro spaces of cargo ships. Ventilation fans are to be of a non-sparking type (see Ch 4, Sec 1, [3.28]).

Ch 4, Sec 11, [4.4.2]

Add the following sentence at the end of the existing requirement [4.4.2]:

A reduced rate of mechanical ventilation capacity may be considered for such spaces when they are of a semi-enclosed type.

Ch 4, Sec 11, [4.5]

Replace requirement [4.5.3] as follows:

4.5.3 Air outlets from high fire risk spaces are to be located at least 3 m away from fuel tanks, filling stations or refuelling stations located on the open deck or in semi-enclosed spaces.

Note 1: "High fire risk spaces" means machinery spaces of category A, ro-ro spaces, cargo holds where fixed fire-fighting systems are required (See Ch 4, Sec 6, [6.1]), galleys, pantries containing cooking appliances, laundry with drying equipment, spaces in which flammable liquids or gases are stored, battery rooms and workshops.

Ch 4, Sec 11, Table 1

Replace rows 1, 2, 7 and 11 as follows.

Delete Table footnote (1).

Table 1 : Space descriptions and hazardous area zones

No.	Description of spaces	Hazardous area
1	The interior of fuel tanks, any pipework or pressure-relief or other venting system for fuel, pipes and equipment containing the fuel or developing flammable gases and vapours. • Drainage tanks as defined in [3.5.2] are covered by this item. • Scuppers and discharges as defined in [3.5.1] are covered by this item • Overflow tanks are covered by this item	Zone 0
2	Enclosed or semi-enclosed filling stations, refuelling stations and, storage holds and fuel handling spaces	Zone 1
7	Enclosed or semi-enclosed spaces having a direct opening into any of the spaces as identified in item 2 or item 3, unless appropriate measures are taken to prevent flammable gas from entering such spaces (protection by overpressure as per [4.3.2], airlock as per [4.3.3] or gastight door as detailed in item 11). This item does not cover areas adjacent to ventilation inlets and outlets which are covered by item 4.	Zone 1
11	Enclosed or semi-enclosed spaces having a direct opening into any of the spaces as identified in item 2 or item 3, which are separated from such space by a self-closing, substantially gastight, steel door without holding back arrangement. This item does not cover areas adjacent to ventilation inlets and outlets which are covered by item 4.	Zone 2

Amendments to PART D

Ch 2, Sec 2, [2.2.1]

Replace "LASHING (restricted area)" by "LASHING (specific area)".

Ch 4, Sec 3, [3.2]

Replace requirement [3.2.1] by:

3.2.1 Application

These requirements apply to ships of length greater than or equal to 150 m, intended for the carriage of bulk cargoes having dry bulkcargo density 1,0 t/m^3 or above and having the service notation **bulk carrier** or **self-unloading bulk carrier ESP** where the unloading system maintains the watertightness during seagoing operations.

In **self-unloading bulk carrier ESP** with unloading systems that do not maintain watertightness, the longitudinal strength in the flooded conditions is to be considered using the extent to which the flooding may occur.

Each cargo hold is to be considered individually flooded up to the equilibrium waterline.

Ch 4, Sec 3, [3.3]

Replace requirement [3.3.1] by:

3.3.1 Application

These requirements apply, in lieu of those in Pt B, Ch 5, Sec 6, [9], to ships with transverse vertically corrugated watertight bulkheads, of length greater than or equal to 150 m, intended for the carriage of bulk cargoes having dry bulkcargo density 1,0 t/m^3 or above and having the service notation **bulk carrier** or **self-unloading bulk carrier ESP** where the unloading system maintains the watertightness during seagoing operations.

In **self-unloading bulk carrier ESP** with unloading systems that do not maintain watertightness, the combination loads acting on the bulkheads in the flooded conditions are to be considered using the extent to which the flooding may occur.

Ch 9, Sec 1, [4.1]

Delete requirement [4.1.21].

Ch 9, Sec 4, [6.2.6]

Replace item c) of the alphanumeric list by:

c) *the design and construction of the heating system shall be included in the approval of the containment system by the Society.*

With reference to application of a) to c), the following requirements are to be considered:

- Heating system is to be such that, in case of a single failure of a mechanical or electrical component in any part of the system, heating can be maintained at not less than 100% of the theoretical heat requirement.
- Where the above requirements are met by duplication of the system components, i.e., heaters, glycol circulation pumps, electrical control panel, auxiliary boilers etc., all electrical components of at least one of the systems are to be supplied from the emergency source of electrical power.
- Where duplication of the primary source of heat, e.g., oil-fired boiler is not feasible, alternative proposals can be accepted such as an electric heater capable of providing 100% of the theoretical heat requirement provided and supplied by an individual circuit arranged separately on the emergency switchboard. Other solutions may be considered towards satisfying the requirements of [6.2.6] provided a suitable risk assessment is conducted to the satisfaction of the Society. The requirement of the previous bullet point continues to apply to all other electrical components in the system.

Ch 9, Sec 4, [7.2.1]

Add the following paragraph and Note 1 at the end of the requirement:

The applicability of the expression "For dome-to-shell connections only" is clarified as follows:

- Welded corners (i.e. corners made of weld metal) are not to be used in the main tank shell construction, i.e. corners between shell side (sloped plane surfaces parallel to hopper or top side inclusive if any) and bottom or top of the tank, and between tank end transverse bulkheads and bottom, top or shell sides (sloped plane surfaces inclusive if any) of the tank. Instead, tank corners which are constructed using bent plating aligned with the tank surfaces and connected with in-plane welds are to be used.
- Tee welds can be accepted for other localised constructions of the shell such as suction well, sump, dome, etc. where tee welds of full penetration type are also to be used.

Note 1: This requirement is applicable to independent tanks of type A or type B, primarily constructed of plane surfaces. This includes the tank corners which are constructed using bent plating which is aligned with the tank surfaces and connected with in-plane welds.

Ch 9, Sec 4, [7.2.2]

Add the following paragraphs at the end of the requirement:

This requirement is applicable to type C independent tanks including bi-lobe tanks, primarily constructed of curved surfaces fitted with a centreline bulkhead.

The applicability of the expression "Other edge preparations" is clarified as follows:

Cruciform full penetration welded joints in a bi-lobe tank with centreline bulkhead can be accepted for the tank structure construction at tank centreline welds with bevel preparation subject to the approval of the Society, based on the results of the tests carried out at the approval of the welding procedure.

Ch 9, Sec 5, [12.1.4]

Replace Note 1 and Note 2 as follows:

Note 1: The expression "a thermal insulation system as required to minimize heat leak into the cargo during transfer operations" means that properties of the piping insulation are to be taken into consideration when calculating the heat balance of the containment system and capacity of the pressure/temperature control system.

Note 2: The expression "cargo piping systems shall be provided with a thermal insulation system as required... to protect personnel from direct contact with cold surfaces" means that surfaces of cargo piping systems with which personnel is likely to contact under normal conditions are to be protected by a thermal insulation, with the exception of the following examples:

- surfaces of cargo piping systems which are protected by physical screening measures to prevent such direct contact
- surfaces of manual valves, having extended spindles that protect the operator from the cargo temperature, and
- surfaces of cargo piping systems whose design temperature (to be determined from inner fluid temperature) is above minus 10°C.

Ch 9, Sec 5, [12.1.5]

Replace Note 1 as follows:

Note 1: SUS304L may be used for cargo piping on the open deck, providing that the coating manufacturer confirms the suitability of the coating with regards to the intended service temperature. SUS316L may be used without specific additional requirement.

Ch 9, Sec 5, [13.3]

Replace requirement [13.3.1] as follows:

13.3.1 General

Each type of valve intended to be used at a working temperature below –55°C shall be subject to the following type tests:

- *each size and type of valve shall be subjected to seat tightness testing over the full range of operating pressures for bi-directional flow and temperatures, at intervals, up to the rated design pressure of the valve. Allowable leakage rates shall be to the requirements of* the Society. *During the testing, satisfactory operation of the valve shall be verified*
- *the flow or capacity shall be certified to a recognized standard for each size and type of valve*

  Note 1: For pressure relief valves (PRVs) that are subject to requirement of Ch 9, Sec 8, [2.1.7], the flow or capacity are to be 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.
- *pressurized components shall be pressure tested to at least 1,5 times the rated pressure, and*
- *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.

Note 2: Refer to SIGTTO Publication on "The Selection and Testing of Valves for LNG Applications".

Note 3: "Emergency shutdown valves, with materials having melting temperatures lower than 925°C" does not include an emergency shutdown valve in which components made of materials having melting temperatures lower than 925°C do not contribute to the shell or seat tightness of the valve.

Ch 9, Sec 7, [8.1.1]

Replace Note 3 as follows:

Note 3: Interpretation of this requirement is that any non-static component (e.g. pump, compressor, fan) is to be duplicated in such a way that a single failure of one of these components will not impair the performance of the pressure/temperature control system.

Static components such as piping or heat exchanger are not necessarily to be duplicated: no redundancy is required for piping and heat exchangers having an operational margin (+25% capacity). With reference to item c), a single heat exchanger without margin (i.e. designed for 100% capacity) may also be not duplicated if another means of pressure/temperature control is provided with a capacity that is at least equivalent to the missing 25% capacity for the heat exchanger.

Ch 9, Sec 8, [2.1.3]

Delete item d) of the alphanumeric list.

Ch 9, Sec 11, [1.3.2]

Replace Note 1 as follows:

Note 1: The survival crafts on board including remote survival crafts required by SOLAS III/31.1.4 facing the cargo area are to be protected by a water-spray system taking into consideration cargo area extension for fire-fighting purposes as stated in [1.1.5].

Remote liferafts located in areas covered by water-spray protection as required in item f) may be considered as adequately protected.

Ch 9, Sec 11, [1.3.5]

Add the following Note 1 at the end of item a) of the alphanumeric list:

Note 1: The expression "two complete athwartship tank groupings" means any two groups of tanks where one group is defined as tanks located in transverse direction from ship side to ship side. Where there is only one cargo tank occupying a hold space from ship side to ship side, it will be considered as a "grouping" for the purpose of this requirement.

"Any two complete athwartship tank groupings" represents an area equal to the combined area of the two largest tank groupings including any gas process units within these areas.

Ch 9, Sec 11, [1.3.8]

Add the following paragraph at the end of the requirement:

Where fuel oil tanks are installed at the after end of the aftermost hold space or at the forward end of the forwardmost hold space instead of cofferdams as allowed for in Ch 9, Sec 3, [1.1.3] and Ch 9, Sec 3, [1.1.4], the weather deck area above these tanks is to be regarded as a "cargo area" for the purpose of applying this requirement.

Ch 9, Sec 11, [1.4.9]

Add the following paragraph at the end of the requirement:

Testing arrangements are to involve the discharge using dry chemical powder from all monitors and hand hose lines on board but it is not required that there is a full discharge of the installed quantity of dry powder. This testing can also be used to satisfy the requirement that the piping is free of obstructions, in lieu of blowing through with dry air all the distribution piping. However, after the completion of this testing, the system, including all monitors and hand hose lines, are to be blown through with dry air but only for the purpose of the system subsequently being clear from any residues of dry chemical powder.

Ch 9, Sec 11, [1.5.2]

Replace reference to "FSS Code" by "Pt C, Ch 4, Sec 15".

Ch 9, Sec 13, [2.1.2]

Replace the second paragraph by the following one:

In order to assess whether or not only one level gauge is acceptable in relation to the aforesaid sentence, the expression "can be maintained" means that any part of the level gauge other than passive parts can be overhauled while the cargo tank is in service.

Ch 9, Sec 16, [4.1]

Add the following new requirement: [4.1.6] as follows:

4.1.6 Classes of gas fuel piping systems

a) Purpose of the classes of piping systems

Piping systems are subdivided into three classes, denoted as class I, class II and class III, for the purpose of acceptance of materials, selection of joints, heat treatment, welding, pressure testing and the certification of fittings.

b) Determination of the classes of piping systems

Piping classes I, II and III for gas fuel piping are to be determined in accordance with the provisions of Tab 1.

Ch 9, Sec 16

Add the following Table 1:

Table 1: Classes of gas fuel piping systems

Piping system	Design conditions		Class of the gas piping		Class of the outer pipe **(1)**
	Design pressure	Design temperature	Single wall arrangement	Double wall arrangement (inner pipe)	
Vent pipes **(2)**	p = 5 bar **(3)**	any	Class III	Class III	Class III
	p > 5 bar and p ≤ 10 bar **(4)**	any	Class II	Class III	Class III
	p > 10 bar **(4)**	any	Class I	Class II	Class III
Gas fuel pipes	p = 10 bar **(5)**	any	Class I	Class II	Class II
	p > 10 bar	any	Class I	Class I	Class II

(1) The design pressure of the outer pipe or duct of fuel systems is to comply with Ch 9, Sec 5, [4.1.4]

(2) Applies to open ended lines, namely:

- discharge lines from thermal relief valves (see Ch 9, Sec 5, [5.3.3])
- venting lines from master gas valves (see [4.6.1])
- purging lines from engines and other gas consumers

(3) The design pressure of vent pipes is not to be taken less than 5 bar. See Ch 9, Sec 5, [4.1.1]

(4) The design pressure of the vent pipe is not to be less than the maximum expected pressure, which is to be justified

(5) The design pressure is not to be taken less than 10 bar. See Ch 9, Sec 5, [4.1.1].

Ch 9, Sec 16, [4]

Replace Sub-article title [4.4] as follows:

4.4 Requirements for gas fuel supply with pressure greater than 1 MPa

Ch 9, Sec 16, [4.4]

Add the following requirement [4.4.7] to [4.4.10]:

4.4.7 Fuel piping in machinery spaces

Gas fuel piping may pass through or extend into machinery spaces or gas-safe spaces other than accommodation spaces, service spaces and control stations provided that they fulfil one of the following conditions:

a) The system complies with [4.3.1], and in addition, with items 1) to 3) below:

1) The pressure in the space between concentric pipes is monitored continuously. Alarm is to be issued and the automatic valves specified in [4.5.1] (hereafter referred to as "interlocked gas valves") and the master gas fuel valves specified in [4.6] (hereafter referred to as "master gas valves") are to be closed before the pressure drops to below the inner pipe pressure (however, an interlocked gas valve connected to the vent outlet is to be opened).

2) The construction and strength of the outer pipes are to comply with the requirements of Ch 9, Sec 5.

3) It is to be so arranged that the inside of the gas fuel supply piping system between the master gas valve and the engine is automatically purged with inert gas when the master gas valve is closed; or

b) The system complies with [4.3.1], and, in addition, with items 1) to 4) below:

1) The materials, construction and strength of protection pipes or ducts and mechanical ventilation systems are to be sufficiently durable against bursting and rapid expansion of high pressure gas in the event of gas pipe burst.

2) The capacity of mechanical ventilating systems is to be determined considering the flow rate of gas fuel and construction and arrangement of protective pipes or ducts, as deemed appropriate by the Society.

3) The air intakes of mechanical ventilating systems are to be provided with non-return devices effective for gas fuel leaks. However, if a gas detector is fitted at the air intakes, this requirement may be dispensed with.

4) The number of flange joints of protective pipes or ducts is to be minimised; or

c) Alternative arrangements to those given in a) and b) will be specially considered by the Society based upon an equivalent level of safety.

4.4.8 Pipe joints

Joints on the entire length of the gas fuel supply lines are to be butt-welded joints with full penetration and to be fully radiographed, except where specially approved by the Society.

4.4.9 Non-welded pipe joints

Pipe joints other than welded joints at the locations specifically approved by the Society are to comply with the appropriate standards recognised by the Society, or with joints whose structural strength has been verified through test analysis as deemed appropriate by the Society.

4.4.10 Post-weld heat treatment

For all butt-welded joints of high pressure gas fuel supply lines, post-weld heat treatment is to be performed depending on the kind of material.

Ch 9, Sec 16, [4.7.1]

Replace reference to "[7.4]" by reference to "[4.3]".

Ch 9, Sec 16, [7]

Replace Sub-article title [7.2] as follows:

7.2 Gas fuel supply to engine with fuel injection pressure greater than 1 MPa

Delete Sub-article [7.3]

Replace the existing Sub-article title [7.4] as follows:

7.4 Shut-off of gas fuel supply with pressure greater than 1 MPa

Replace the existing Sub-article title [7.5] as follows:

7.5 Emergency stop of dual fuel engines with fuel injection pressure greater than 1 MPa

Amendments to PART E

Ch 1, Sec 1, [1.1.1]

Replace the second paragraph by the following one:

These service notations are always completed by the additional service feature **standardized design bollard pull = [T_{BP} /9,81] t**, where the design Bollard Pull T_{BP} is defined in [2.1].

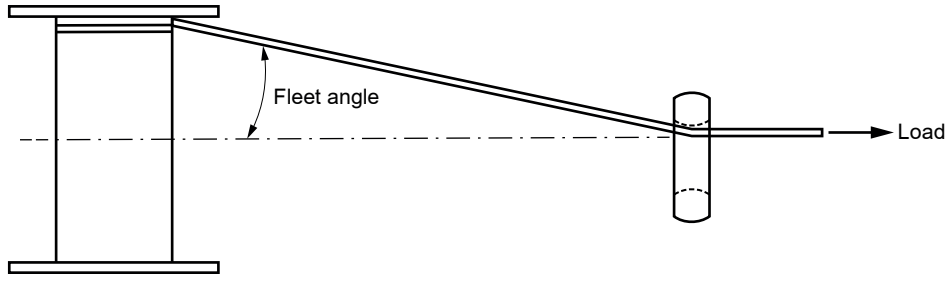
Ch 1, Sec 1, [2.8]

Delete requirement [2.8.3].

Ch 1, Sec 1

Replace Figure 3 by the following one:

Figure 3 : Towline fleet angle



Ch 1, Sec 2, [2.3]

Replace requirement [2.3.2] by:

2.3.2 All the loading conditions reported in the trim and stability booklet which are intended for towing operations are also to be checked in order to investigate the ship's capability to withstand the effect of the transverse heeling moments induced by:

- the combined action of the towline force and the thrust vector (self-tripping, see [2.3.3])
- the hydrodynamic resistance of the hull (tow-tripping, see [2.3.4]).

Ch 1, Sec 3, [2.3.1]

Replace the term "moulded draught" by "scantling draught".

Ch 1, Sec 5, [2.1]

Replace requirement [2.1.1] by:

2.1.1 The design bollard pull is to be verified by means of a bollard pull test performed in accordance with Ch 1, App 1.

Replace requirement [2.1.4] by:

2.1.4 The bollard pull test is to be carried out in the presence of a Surveyor of the Society. The test procedure location and conditions (see Ch 1, App 1, [3]) are to be agreed with the Society.

Ch 1, App 1

Add the following new Appendix 1:

APPENDIX 1 BOLLARD PULL TRIALS

1 General

1.1 Purpose

1.1.1 The purpose of this Appendix is to:

- ensure that the reported bollard pull figure represents the realistic performance of the vessel that can be met in service conditions at an acceptable level of accuracy, irrespective of the specific conditions met during the execution of the bollard pull trial that are known to affect the vessel's performance
- facilitate a repeatable performance figure in accordance with clear definitions.

1.2 Application

1.2.1 This Appendix applies to ships with multiple propulsors, with or without nozzles.

1.2.2 This Appendix does not apply to the following ships:

- ships whereby propulsors are mounted under a large flat bottom (e.g. specialised ships with multiple thrusters for dynamic positioning operation)
- single propulsor towing vessels.

2 General requirements

2.1 Bollard pull trial

2.1.1 A bollard pull trial is a full scale test with a vessel to determine the horizontal towline force which the main propulsion systems can generate at a vessel speed equal to zero knots.

The bollard pull trial is to be executed in unrestricted and calm water, without external influences such as wind and current. One end of the towline is to be attached to a dedicated towing point on the vessel (e.g. towing winch or hook) and the other end is to be attached to an external strongpoint (fixed bollard ashore, seabed secured anchor or otherwise). The towline force is to be measured by a calibrated load cell which is normally fitted between the towline and the external strongpoint. The engine power at which the bollard pull trial is executed is to be measured and reported in conjunction with the steady state line pull.

2.2 Bollard pull trial conditions

2.2.1 The vessel's bollard pull is the towing force provided by the specified propulsors, recorded as being maintained in a steady state condition for a duration of not less than 5 minutes and performed at rated power as defined in [2.3.1] at a speed through water of zero knots.

2.2.2 The operating profile for the bollard pull trial condition is to represent normal service conditions, such that sufficient auxiliary power is available for normal and safe operation of the vessel.

2.2.3 Engine speed and brake power are to be measured simultaneously with towline force during the bollard pull trial and are to be reported on the test report (see [8]).

2.2.4 Bollard pull trials conducted in hybrid mode, whereby batteries or other supplementary power devices are used to provide additional power for a limited period of time, are to be separately listed as “Hybrid Bollard Pull (HBP)”, and have an associated time of validity for each operational mode of such HBP.

2.3 Engine rating

2.3.1 The bollard pull trial is to be performed up to the maximum power of the engines which is available in service. Maximum power means:

a) For marine diesel and/or gas engines: The maximum brake power that the engine can deliver in service, and that corresponds to the power recorded during 100% load testing at the Factory Acceptance Tests of the engine.

b) For electric propulsion machines: Design power for normal service conditions defined for the electric motor, specified on the motor name plate.

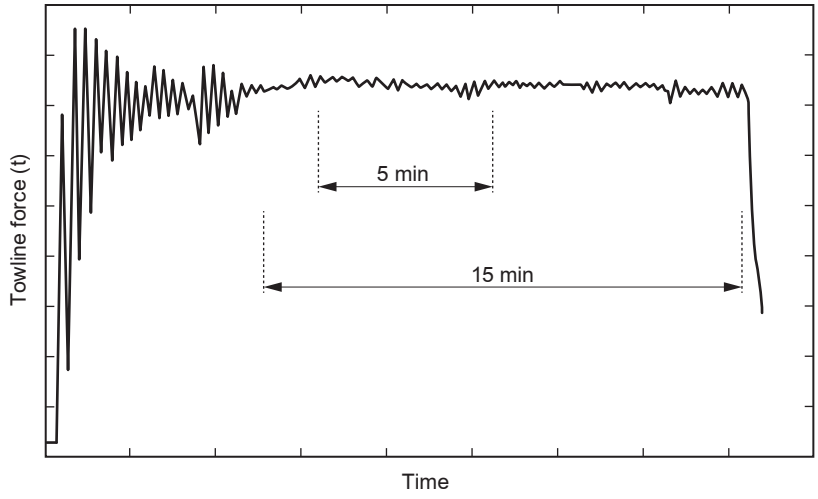
c) For Hybrid propulsion systems (diesel or gas mechanical propulsion with electrical power take-in):

The sum of the power defined in item a) and item b) above for all propulsion machines.

d) In case the design power of the propeller is less than the maximum power of the engine(s), the maximum power is to be taken as the design power of the propeller.

2.3.2 The engine speed is to be within the Original Equipment Manufacturer (OEM) specified speed range, which is to be consistent with the type approval of the engine and the certification of the propulsion train (e.g. Torsional Vibration Calculations).

Figure 1 : Schematic representation of towline force as a function of time during bollard pull trial



2.3.3 The available output power has to match the conditions stated in [2.2.2].

2.3.4 The propulsion and engine configuration used during the bollard pull trial is to be stated on the certificate. This includes a specification of the power generation systems (output of engines / fuel cells / battery banks etc.), propulsion motors (mechanical, electrical, hybrid) and propulsion systems (number of propellers, use of (retractable) thrusters etc.) used during the bollard pull trial.

2.4 Steady state phase

2.4.1 The steady state phase of the bollard pull trial is the time interval during which a steady towline force is measured. The steady state phase represents the highest consecutive 5 minute period, logged as per [4.4] during a 15 minute trial under effectively constant trial conditions stated in this trial test procedure. The definition of the highest consecutive 5 minutes period is to be in accordance with [7.2].

2.4.2 The 15 minute trial window starts after the initial build up and subsidence in line tension of associated dynamic effects, as shown in Fig 1. During this period only small changes in steering angles associated with maintenance of vessel position are permitted. Strong sway motions are to be avoided.

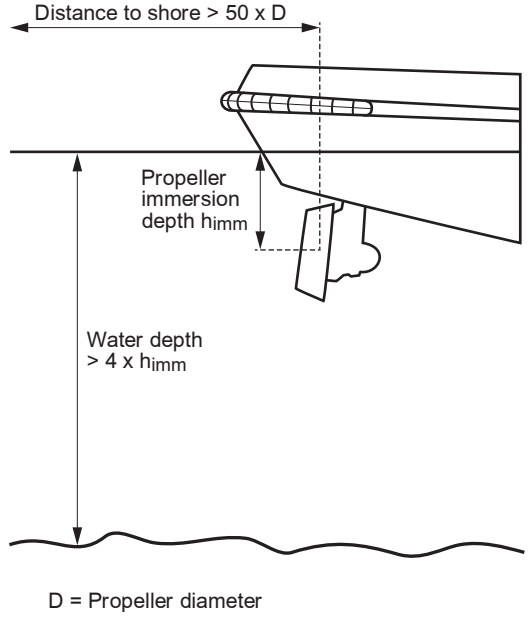
2.4.3 In Hybrid mode (Diesel/Diesel-Electric power plus that available from the batteries) the available battery power for propulsion might decrease during the execution of the bollard pull trial. In this case the reported bollard pull is to be defined by calculating the mean power and towline force over a period of 5 minutes as minimum, and noted down as a separate entry in the bollard pull certificate as 'Hybrid Bollard Pull (HBP)' with an associated maximum time for which that HBP rating is valid in service. The designed power availability duration is to be provided by the designer of the propulsion system.

3 Requirements for the trial site

3.1 Water depth and radius

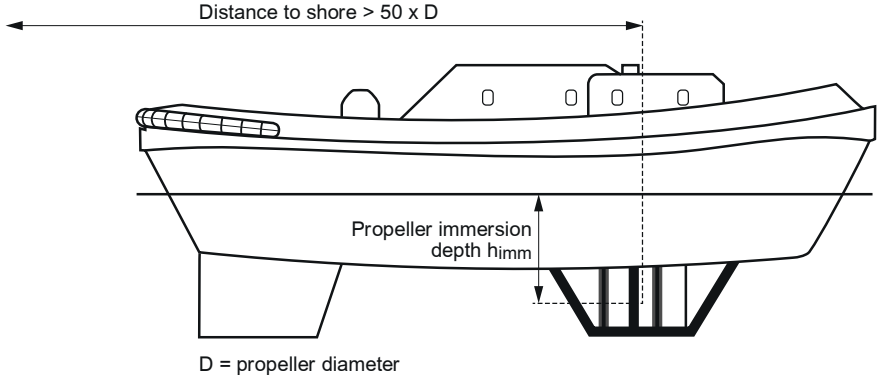
3.1.1 The minimum total water depth, which is to be maintained at least in a radius of 2 times the ship's length around the towing vessel, is 4 times the propeller immersion depth (h_{imm}).

Figure 2 : Definition of propeller immersion depth and ship to shore distance



3.1.2 The propeller immersion depth is the distance between the water surface and the centre of the propulsion unit, as indicated in Fig 2. For propulsion systems with vertical axis, the centre line of the jet-stream is used, i.e. the middle of the blades as indicated in Fig 3.

Figure 3 : Definition of immersion depth and ship to shore distance for a propulsion system with vertical axis



3.1.3 The water depth during the trial is to be recorded on the bollard pull trial report.

3.2 Ship to shore distance

3.2.1 The minimum distance between quay and centre of the propeller closest to shore is 50 times the propeller diameter to avoid water circulation affecting the bollard pull.

3.3 Current

3.3.1 The current speed is to be less than 0,5 knots from the bow or sides. If the current is approaching the vessel from the stern, the current is to be less than 0,3 knots. When the bollard pull trial is performed with side current, the towing vessel is to be allowed to shift position by letting it move with the current and not to steer against it, while maintaining heading relative to the towline. It is not allowed to fix the position of the towing vessel by cables, other vessels or other means. Bow thrusters may be used to hold position if this does not negatively affect the power available for main propulsion, see also [6.1.1].

3.4 Water density

3.4.1 Water density is to be recorded on the bollard pull trial report. No corrections for water density are to be applied.

3.5 Waves

3.5.1 The bollard pull trial is to be conducted in calm water conditions as far as possible. In any case, the maximum significant wave height encountered during the bollard pull trial is not to exceed 0,5 m. No corrections for waves are to be applied.

3.6 Wind

3.6.1 Transverse wind may cause sway movements that have to be compensated by applying rudder. This may degrade vessel bollard pull performance. Wind speed during the bollard pull trial is to be as low as possible but not more than 10m/s (5 Beaufort scale).

3.7 Outside temperature

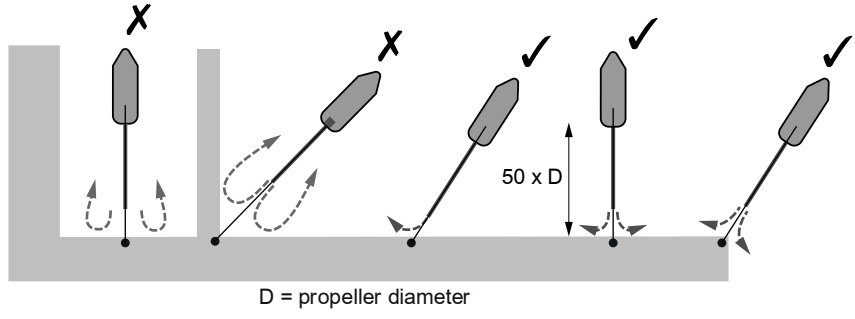
3.7.1 It is recommended to perform trials in non-tropic conditions (air temperature < 45°C, water temperature < 32°C) to avoid engine performance degradation. No corrections for environmental conditions are to be applied.

Note 1: It is recommended to log relevant engine parameters during the trials.

3.8 Towline

3.8.1 A torsion-free towline (e.g. synthetic) is recommended to ensure that the load cell measures, as intended, in direct tension.

Figure 4 : Positioning of the vessel during bollard pull trials



3.9 Vessel orientation relative to the quay

3.9.1 The heading relative to the quay side (assuming solid quay sides) is to be chosen such that propeller wash can freely move without being re-directed in the direction of the vessel. Towing is not to be done in enclosed harbours, as recirculation is more likely to occur, resulting in unsteady performance. Minimum line length, water depth and associated radius are to be observed. Fig 4 presents examples of acceptable and unacceptable vessel orientations relative to the quay.

4 Instrumentation

4.1 Load cell

4.1.1 The load cell is to be installed between the strongpoint and towline, either on board or on shore. The load cell is to have a digital output and be capable of sampling at a rate of 1 Hz or faster.

4.1.2 To maximise accuracy the following conditions are to be met:

a) The load cell calibration and certificate is not to be older than 12 months and is to be provided with the bollard pull certificate. The calibration procedure of the load cell is to be in accordance with the requirements stated in [4.1.3].

b) The load cell is to have an uncertainty in accordance with an ISO 7500-1 Class 1 machine, which is to be stated on the load cell calibration certificate.

c) When a steel stranded wire is used during the bollard pull trial, the load cell is to be proven to be torsion insensitive in accordance to the requirements in [4.1.4].

d) Spacer rings are to be installed between load cell and shackle ears as indicated in Fig 5 to avoid misalignments during testing. Spacer rings are plastic rings specially made to fill the gaps between shackle ears and load cell, and thus centrally align the load cell.

e) Shackle pins are to be free from surface imperfections such as dents or bend.

f) The towline is to be connected first to a shackle, which is consecutively connected to a second shackle that holds the load cell (see Fig 5).

g) When a load pin shackle is used, a centralising bobbin as indicated in Fig 6 is to be used in order to ensure correct alignment, in addition to additional shackles. The towline is not to be connected directly to the load shackle.

h) The load cell / load shackle and connected shackles are not to touch the quayside edge or ground (see Fig 7) to avoid misalignment, bending and corresponding offsets in measurements. The shackles denoted by 'Additional Shackles' in Fig 5 are allowed to touch the ground if not possible otherwise.

i) The test is to be conducted at the same temperature as during the calibration of the load cell, within a tolerance of ±10°C. If this condition cannot be fulfilled, the load cell is to be certified to be suitable for the temperature during the trial.

j) The load cell is to be set to zero prior to the trial, when the towline is not yet connected and free from any load. After the trial, when the load cell is free from any load, the reading is to be checked again.

Figure 5 : Recommended load cell arrangement with spacer rings and additional shackles

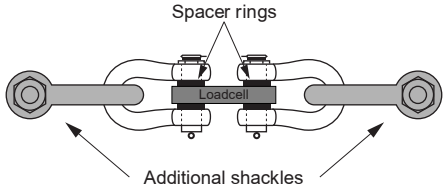


Figure 6 : Recommended load shackle arrangement with centralising bobbin and shackles

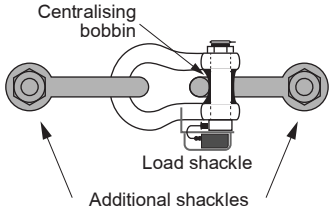


Figure 7 : Load cell touching ground, causing bending moments and misalignment of the load cell

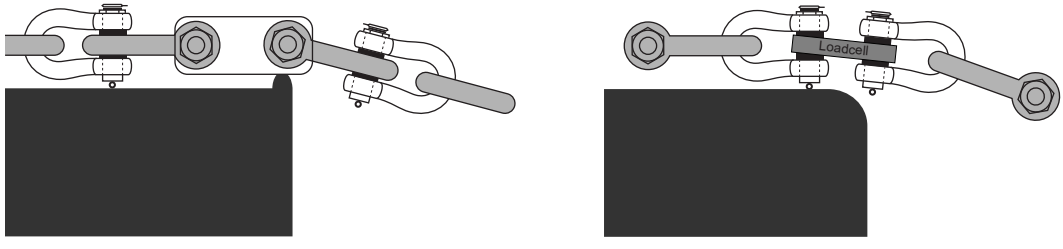
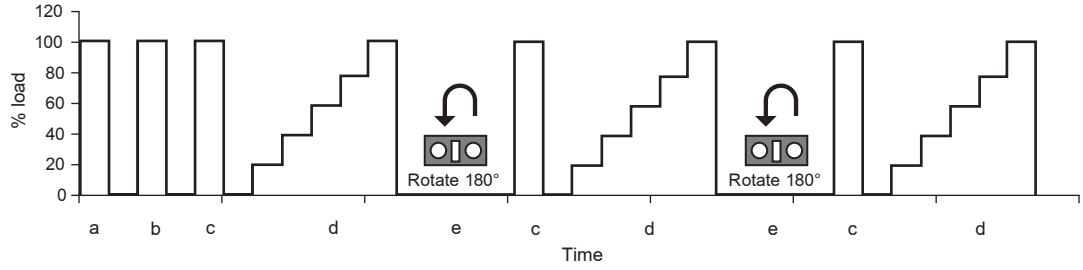


Figure 8 : Schematic of calibration procedure according to ISO 7500-1



4.1.3 Load cell calibration requirements

Load cells are to be calibrated according to ISO 7500-1 ("standard calibration"). The load cell is to be calibrated with the same shackle pin diameter as it is used during bollard pull testing. If calibration is done on a horizontal calibration machine, spacer rings are to be used to improve alignment.

Fig 8 presents a schematic of the calibration procedure, which consists of the following steps in chronological order:

a) pre-load to the maximum of the load cell's scale

b) pre-load to the maximum of the load cell's scale

c) pre-load to the maximum of the load cell's scale

d) stepwise load increase comprising at least five discrete force levels at equal intervals between 20% and 100% of the maximum range of the scale

e) rotation of the load cell by 180 degrees, around the X, Y or Z axis and a rotation of the shackle pins connected with the load cell by 30 degrees

f) repetition of steps c- e for two more times.

For each discrete force, the arithmetic mean of the values obtained for each series of measurements is to be calculated. From these mean values, the relative accuracy error and the relative repeatability error are to be calculated. The preload runs are to be omitted.

4.1.4 Torsional insensitivity

When a steel stranded wire is used during the bollard pull trial, the load cell is to be proven to be torsional insensitive to a torsion value T, in kN.m, of at least:

$$T = C_1 \cdot BP_{design} \cdot D_{line}$$

Where:

BP_{design} : Vessel's design bollard pull at 100% engine load, in kN

C_1 : Towline wire torsion factor (c_1 = 0,07 for 6/36 steel stranded wires, unless documented otherwise)

D_{Line} : Diameter of the towline, in m.

The insensitivity of the load cell is to be proven by the load cell manufacturer by means of systematic tests. When a rotation resistant rope is used (e.g. some synthetic ropes), this requirement is not applicable.

4.2 Engine speed measurement

4.2.1 The engine speed is to be continuously measured using a pickup sensor or via the engine control system of the engine's manufacturer and recorded digitally during the trial.

4.3 Power measurement

4.3.1 Engine brake power is to be measured using a dedicated shaft torque / engine speed measurement system for first and second ships of a series. Torque measurement systems based on strain gauges are most common, but other techniques, e.g. using optical deflection measurement, are also allowed. Engine speed can be measured using an optical or magnetic pickup sensor.

4.3.2 The power measurement is to represent engine brake power as tested during shop tests. For third and further of series the engine control system can be used provided its accuracy has been verified based on the first two vessels of a series. The dedicated shaft torsion/engine speed sensor reading is leading for the engine power.

4.3.3 The uncertainty of the engine power measurement should be according to ITTC standard 7.5-04-01-01.1 (total bias uncertainty +/-2%).

4.3.4 Shaft material properties, i.e. the G-Modulus, are to be fully described and documented by the Shipbuilder. If no certificate based on an actual shaft torsional test is available, a G-Modulus of 82400 N/mm^2 is to be used for regular shaft steel.

Figure 9 : Power measurement on a diesel direct propulsion arrangement

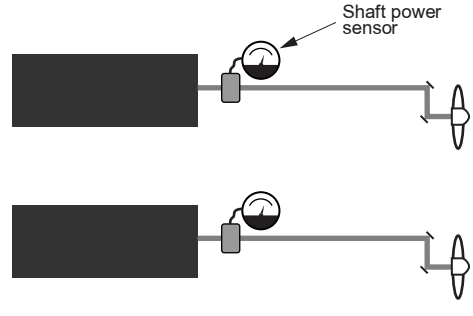


Figure 10 : Power measurement on a geared diesel direct propulsion arrangement with PTO (declutched)

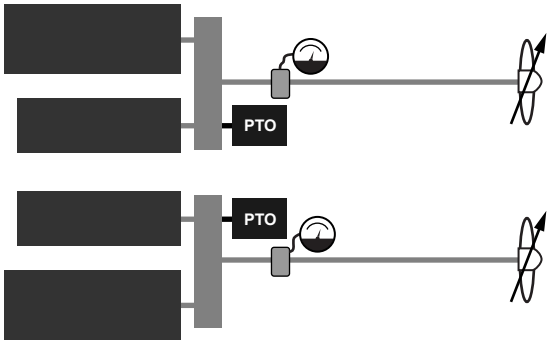


Figure 11 : Power measurement on a Hybrid propulsion arrangement

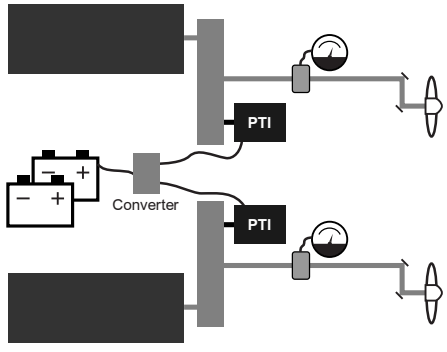
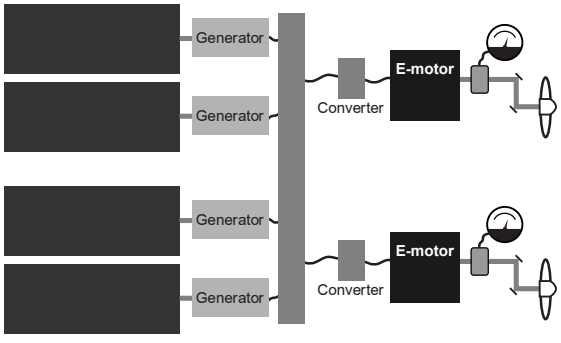


Figure 12 : Power measurement on a Diesel-Electric propulsion arrangement



4.3.5 If power cannot be measured directly on the engine's output shaft, it may be calculated by measuring power on the propeller shaft and correcting for power losses between engine flywheel and measurement point. These losses are to be confirmed by their respective manufacturer and stated in the trial report. Suggested measurement locations for various propulsion configurations are included in Note 1.

Note 1: The objective of the power measurement is to measure engine brake power. For ships with a diesel direct propulsion layout (see Fig 9), the shaft power measurement system can be installed directly on the output shaft of the engine, as close to the engine as possible to avoid shaft losses.

For ships with multiple engines coupled to a gearbox (see Fig 10), where there is insufficient space between main engine and gearbox to install a shaft power meter shaft power is to be measured on the propeller shaft. If a PTO is installed, it is to be declutched or unloaded. Auxiliaries connected to the gearbox or PTO that are necessary for the normal operation of the engine such as cooling or oil circulation pumps are to remain operational during the test. The main engine brake power is to be calculated by calculating the gearbox losses and adding them to the measured shaft power.

For ships with a hybrid propulsion system (see Fig 11), where both an electric motor and combustion engine provide power to a single shaft, the combined power is to be measured. Both the combustion engine and PTI are not to run at a rating higher than 100% load.

For diesel electric ships (see Fig 12) the design power of the electric motor is the limiting factor for power output. The brake power of the electric motor is to be determined using a power measurement system on the output shaft. If this is not possible, the power to the electric motor is to be determined with a power spectrum analyser or other means.

4.3.6 In case carbon shafts are used and no steel section is available for the installation of a power measurement system, the engine rating during the bollard pull trial is to be determined on a case by case basis with the parties involved. Without a direct measurement of the shaft brake power, no power is to be reported on the trial certificate.

4.3.7 The power meter zero setting is to be done according to its maker's instructions prior to the trials.

4.4 Data logging

4.4.1 The readings of the towline force, engine speed and shaft torque are to be recorded continuously and automatically on a digital system with a sample frequency of at least 1 Hz in order to capture the natural fluctuations in the forces. A higher sampling rate is recommended to identify measurement errors and dynamic effects more clearly. Each load cell reading is to be tagged with a time stamp and synchronised with the power measurements on the vessel.

4.4.2 Measurement is to commence prior to the bollard pull trial, so that the steady state phase and no-load reading can be identified during post processing of the data.

4.4.3 The following data are to be recorded at the beginning of the trial: Draft and trim, wind, waves, current, water depth, water density, distance to quay, fuel quality, towline diameter, length, and material. If conditions vary during the test, the variances at completion of the trial are also to be recorded.

5 Trial preparation

5.1 Draught and trim

5.1.1 The draught and trim of the towing vessel are to be representative for typical service conditions and are to be stated on the certificate.

5.2 Propellers

5.2.1 The propellers used during the trial are to be the same as used for service conditions. It is strongly recommended to clean/polish the propellers immediately before trials, as blade roughness and fouling negatively affects thrust and power efficiency.

5.3 Fuel

5.3.1 The fuel used during the trial is to be representative for the normal service operation of the vessel. The fuel type and calorific value are to be stated on the certificate.

6 Trial execution

6.1 General

6.1.1 During the trial a visual observation of the load cell reading on the bridge is recommended, so that the commencement of the steady state phase can be judged. Minimal sway motion is recommended to avoid performance drops. The use of a bow thruster is allowed to maintain position during the trial, when this does not affect the power available to the main propulsion system. Stern side thrusters are not to be used unless it is demonstrated that they do not affect the inflow velocity.

6.1.2 At least four power settings are to be tested between 25% and 100% load: maximum power in accordance with [2.3.1], 85%, 60% and 40% of the rated power are recommended.

6.2 Steps to be performed

6.2.1 The following steps are to be performed for the bollard pull trial:

a) Make sure the load cell, wireless indicator, test location and environmental conditions are according to the requirements stated in this Appendix.

b) Tare the load cell (set to zero) prior to the test when the load cell and shackles are not yet connected.

c) Connect load cell and towline. Slowly put tension on the towline. Ensure correct alignment of the load cell and shackles. Re-align when necessary.

d) Increase tension on the towline until the maximum power, as defined in [2.3.1] is reached. Check power rating using the engine shaft power meter.

e) When the vessel has a stable position and heading and line fluctuations are constant, start a 15 minute run recording the towline force, power and engine speed.

f) Reduce power to other engine ratings (85%, 60% and 40% recommended). When the vessel is stable and line fluctuations are constant, start measurement. The minimum measurement period is hereby 5 minutes. A longer period (15 min) is recommended to capture a more stable performance.

g) Repeat steps b) to f) for the other direction of towing (stern / bow) if applicable.

6.2.2 During the test a log sheet is to be filled in. Minimum reporting requirements are listed in Article [8].

7 Data analysis

7.1 Validation of recorded data

7.1.1 The logged towline force is to be plotted on a time scale and evaluated for measurement errors, outliers and to identify the steady state period. The towline force is to have a smooth, sinusoidal character as a function of the mass-spring system behaviour of the towline and vessel. If the data quality is poor, indicated by stepwise data, missing data and large non-periodic fluctuations, the bollard pull trial is to be repeated.

7.2 Identification of steady state performance

7.2.1 The determination of the highest consecutive 5 minute period of stationary performance is to be performed after the trial using the logged data. The calculation of the average bollard pull over the 5 minute period is performed using a normal arithmetic average over the selected period (using at least 300 consecutive data points). Clear outliers due to sensor errors are to be removed prior to calculation of the average. The average of the propulsion power and engine speed is to be determined over the same 5 minute data period.

8 Reporting

8.1 Trial report requirements

8.1.1 The bollard pull test certificate is to be accompanied with a trial report. The report is to contain at least the following information:

- characteristics of the vessel, propulsion system and main engines/propulsion motors, including Original Equipment manufacturer (OEM)-defined consecutive periods of available maximum power
- the propulsion and engine configuration used during the bollard pull trial. This includes a specification of the power generation systems (output of engines / fuel cells / battery banks etc.), propulsion motors (mechanical, electrical, hybrid) and propulsion systems (number of propellers, use of retractable thrusters etc.) used during the bollard pull trial
- used method of power measurement and used mechanical/electrical efficiency if applicable
- fuel characteristics
- location, water depth and line length during the trial
- environmental characteristics: ambient temperature, wave height, water density, wind and current speed and direction relative to the vessel
- towline and load cell-shackle arrangement
- calibration certificate of load cell
- log sheet with results of each 5 minute trial, including power, engine speed and line pull for all tested load cases
- name and contact information for persons performing and witnessing the trial on behalf of shipyard, owner and main component manufacturers

- for re-evaluation trials at part-load operation: the original bollard pull - shaft power curve including the measured points at part load, and the calculation method to derive to the resulting extrapolated bollard pull at maximum power.

9 Part load bollard pull re-evaluation trials

9.1 Application

9.1.1 A new bollard pull trial is required:

- for class renewal; or
- in case of overhaul or alteration of the engines and/or propulsion system.

In those cases where a suitable bollard is unavailable, e.g. because the available bollard has an insufficient safe working load, bollard pull trials may be performed at reduced load. These trials are no substitute for full bollard pull trials, but can be used to evaluate the validity of previous test results performed at 100% load. This Article lists the prerequisites for such trials, the test and analysis procedure.

9.2 Trial overview

9.2.1 A full-range bollard pull trial as described in [6] provides a bollard pull versus shaft power performance curve over the complete power range. This curve is to be evaluated in the performance re-evaluation trials at part load. The performance re-evaluation is to be done in three steps:

- Step 1: The capabilities of the engines after overhaul are evaluated, by testing each individual prime mover separately at the highest power the engine can deliver (in compliance with [2.3]). The engine power is hereby logged.
- Step 2: A bollard pull trial is performed at the maximum safe working load of the bollard with all prime movers in operation, but at part load.
- Step 3: The measured bollard pull is compared with the original performance curve of the vessel. If the measurement results are within ±3% the original curve, the original curve is still valid and can be intersected at the combined maximum power measured in step 1. If the deviations are larger the curve is to be shifted accordingly.

9.3 Prerequisites

9.3.1 Bollard Pull Performance Re-evaluation Trials are only valid when the following conditions are met:

a) Bollard pull trials have been performed in the past where a minimum of 4 power settings have been tested between 25% and 100% rated power according to this Appendix, whereby delivered power is measured using a dedicated power measurement system on the drive shafts.

b) The maximum rated power of each prime mover can be tested separately. For ships with combinator mode and father/son arrangement, a temporary change in engine speed-pitch may be necessary to avoid overloading the engine when testing one engine per shaft.

c) The same propeller and nozzles as during the initial full load bollard pull trial are in place.

d) The propellers are re-conditioned (polished) to the same condition as for the initial full load bollard pull trial according to the relevant ISO propeller class or similar.

e) The propeller nozzles have no surface damage and are in the same condition as for the initial full load bollard pull trial.

f) A bollard is available with a safe working load that exceeds the power rating of each individual prime mover, so that the maximum power of each prime mover can be safely tested. For example, for tugs with a father/son engine arrangement, with two engines providing 60% / 40% of the total available power, the bollard is to be strong enough to hold the bollard pull obtained at 60% of the total available power.

9.3.2 If the above conditions cannot be met, normal bollard pull trials according to Article [6] are to be performed.

9.4 Step 1: Evaluation of engine power

9.4.1 The engine capability of each prime mover is determined by loading the engine up to 100% load in a bollard pull setup (zero ship speed). The following procedure is to be followed:

a) Tare the shaft power measurement system according to manufacturer recommendations

b) Make sure the test location and environmental conditions are according to the requirements stated in this Appendix

c) Slowly put tension on the towline

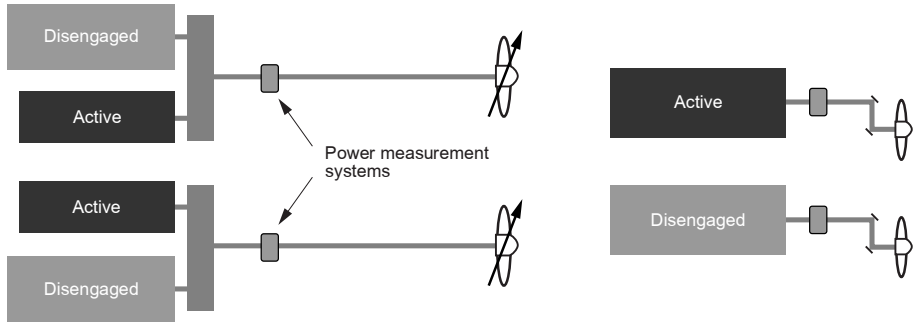
- for vessels with multiple prime movers per propeller: engage one prime mover per shaft. Operate both shafts for symmetric operation (see Fig 13, left arrangement)
- for vessels with 2 propellers and two engines: disengage one propulsion unit so only one propeller is in operation. The other propeller may weather vane or stand still (see Fig 13, right arrangement)
- for vessels with multiple propellers: engage one prime mover

d) Increase power up to the power as stated in [2.3]

e) Stabilise vessel and start a 5 minute power measurement. Bollard pull is not measured. For ships with one propeller in operation strong rudder usage may be necessary to stabilize vessel

f) Repeat step c) and d) to test the other prime movers

Figure 13 : Propulsion configurations for individual engine performance testing



g) Calculate the total power capacity, P_{Total}, of the main engines using:

$$P_{Total} = \frac{\sum_{i=1}^{n} P_{ME(i)}}{\eta_{gear}}$$

Where:

P_{Total} : Total available power for all prime movers combined

P_{ME} : Engine power for each 'i' prime mover as obtained in step (d) and (e)

η_{gear} : Gearbox efficiency ($\eta_{gear} = 1$ when there is no gearbox between measurement system and engine output shaft). The same gearbox efficiency as used during the new-build bollard pull trials is to be used.

9.5 Step 2: Re-evaluation of propulsion efficiency

9.5.1 The propulsion efficiency curve (towline force versus shaft power) is to be evaluated at the maximum safe working load of the bollard. The following procedure is to be followed:

a) Make sure the load cell, wireless indicator, test location and environmental conditions are according to the requirements stated in this Appendix.

b) Tare the load cell prior to the test when the load cell and shackles are not yet connected.

c) Ensure correct alignment of the load cell and shackles. Re-align when necessary.

d) Engage all engines and propellers and increase power until towline tension has reached maximum safe working load of bollard.

e) When the vessel is stable and line fluctuations are constant, start a 15 minute run recording the bollard pull, power and engine speed in accordance with the procedure documented in [6].

f) Reduce power to 40% of the total available power. When the vessel is stable and line fluctuations are constant, start a new 15 minute run recording the bollard pull, power and engine speed.

g) Repeat above steps for astern operation if applicable.

h) Plot measurement results in the original propulsion efficiency curve.

Steps a) to f) are to be performed in accordance with the normal procedures and environmental restrictions as documented in this Appendix.

9.6 Step 3: Re-evaluation of bollard pull capability at available power

9.6.1 The offset between the measured data points and the original performance is to be assessed through the towline pull ratio, α_{BP}:

$$\alpha_{BP} = \frac{BP_{Evaluate}}{BP_{original}}$$

Where

$BP_{Evaluate}$: Bollard pull-power performance curve obtained during re-evaluation trials, (see [9.5])

$BP_{Original}$: Original Bollard pull-Power performance curve from full power trials.

To obtain the bollard pull at P_{Total} either the original performance curve is used, or the curve is first shifted:

a) if $0,97 < \alpha_{BP} < 1,03$ the original BP-Power curve is used to intersect the new bollard pull capability at P_{Total}, as shown in Fig 14

b) if $\alpha_{BP} > 1,03$, it is to be demonstrated that the applicable hull structure and stability requirements are complied with

c) if $\alpha_{BP} < 0,97$, the curve is shifted vertically by multiplying the curve with α_{BP} to match the data points, as depicted in Fig 15.

If P_{Total} is more than the highest power rating from the original BP-trial, the bollard pull is determined from the highest rating from the original BP-trial. No extrapolation beyond the original curve is allowed.

For tests in ahead direction the curve for ahead trials is to be used; for astern trials the curve for astern direction.

9.7 Presentation of results

9.7.1 The original Shaft power - Bollard pull curve including its measurement points, and the method to derive to the resulting extrapolated bollard pull at rated power, is to be clearly documented.

Figure 14 : Procedure for estimating bollard pull at P_{Total} from part load trials

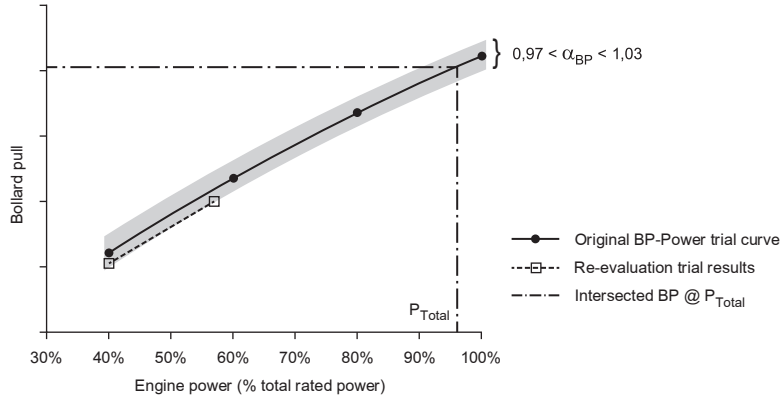
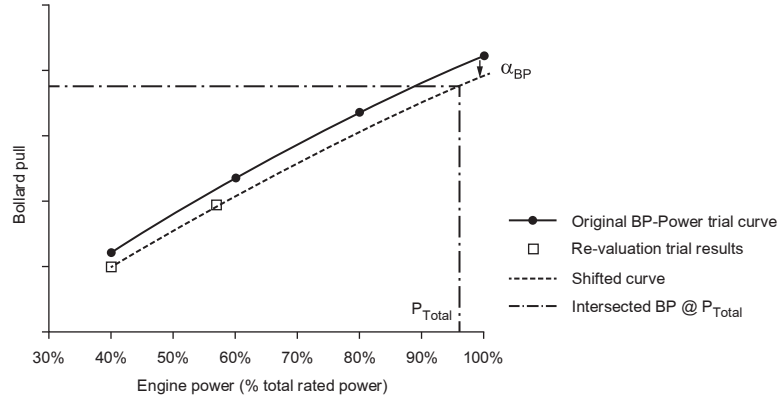


Figure 15 : Procedure for estimating bollard pull at P_{Total} when α_{BP} < 0,97



Amendments to PART F

Ch 2, Sec 2, [2.2]

Replace requirement [2.2.3] as follows:

2.2.3 Where a propulsion system becomes inoperative due to a failure as indicated in [2.2.2] above, the following conditions are to be satisfied:

- other propulsion systems that were in operation before the failure are not to be affected by the failure. In particular there should be no significant modification of the power or rotational speed of the concerned prime mover
- other propulsion systems that were not in operation before the failure are to be maintained available (heating and prelubrication) so as to allow restarting of propulsion system within 45 seconds after the failure

  Note 1:The blackout recovery time is excluded, however restarting time for propulsion system in case of blackout is not to exceed 120 seconds.
- safety precautions for the failed propulsion system are to be taken, such as shaft blocking.

This is to be demonstrated during the sea trials.

Ch 2, Sec 2, [2.3]

Replace requirement [2.3.1] as follows:

2.3.1 The steering machinery is to consist of at least two independent steering systems, each one complying with the following provisions:

- Pt C, Ch 1, Sec 11, [2] in the case of a standard arrangement with rudder and steering gear, and in particular the requirement of Pt C, Ch 1, Sec 11, [2.2.1] relating to the performance of the steering gear
- Pt C, Ch 1, Sec 11, [4] in the case of rotatable thrusters.

Note 1: Other types of combined propulsion and steering systems (such as waterjets or cycloidal propellers) will be given special consideration.

Ch 3, Sec 1, [1.1.1], Note 1

Replace reference to "Pt C, Ch 1, Sec 1, [1.4.2]" by reference to "Pt C, Ch 4, Sec 1, [3.23.1]".

Ch 3, Sec 1, [3.2]

Replace requirement [3.2.4] as follows:

3.2.4 An automatic fire detection system is to be fitted in machinery spaces of category A, as defined in Pt C, Ch 4, Sec 1, [3.24.1], intended to be unattended.

Ch 9, Sec 1, Table 2

Replace the row "CLEANSHIP CLEANSHIP SUPER" as follows:

Table 2 : Required certificates

Notations	Certificate	Applicable Rules and Regulations
CLEANSHIP **CLEANSHIP SUPER**	IOPP certificate **(1)**	Annex I of MARPOL 73/78, Appendix II
	Type approval certificate of: • 15 ppm bilge separator • 15 ppm bilge alarm	IMO Resolution MEPC.107(49): • Part 1 of the Annex • Part 2 of the Annex
	ISPP certificate **(1)**	Annex IV of MARPOL 73/78, Appendix
	Type approval certificate of the sewage system	IMO Resolution MEPC.227(64) as amended by IMO Resolution MEPC.284(70)
	Type approval certificate of the incinerator **(2)**	• IMO Resolution MEPC.244(66) • Annex VI of MARPOL 73/78, Appendix IV
	IAPP certificate **(1)**	• Annex VI of MARPOL 73/78, Appendix I • IMO Resolution MEPC.194(61)
	EIAPP certificates of diesel engines **(3) (4)**	NOx Technical Code 2008, Appendix I
	SOx emission compliance certificate Certificate of unit approval for exhaust gas cleaning system **(5)**	IMO Resolution MEPC.259(68)
	IAFS certificate or Declaration on Anti-fouling system	International Convention on the control of Harmful and Anti-fouling systems, 2001, Annex 4, Appendices 1 and 2

Ch 11, Sec 2, [2.1.1]

Replace the definition of "t_G" by the following one:

t_G : Additional net thickness for taking account of grab impacts, to be taken equal to 3,5 mm. For inner bottom plating, where no continuous wooden ceiling is fitted, t_G includes the 2 mm required in Pt B, Ch 7, Sec 1, [2.4.1] or NR600, as applicable.

Ch 11 Sec 5, [1.1.5] and [1.1.6]

Replace "LASHING (restricted area)" by "LASHING (specific area)".

Ch 11 Sec 5, [1.2.1] and [1.2.3]

Replace "LASHING (restricted area)" by "LASHING (specific area)".

Ch 11, Sec 13, [2.1.1]

Replace the first paragraph by the following one:

2.1.1 Oil fuel tanks are to be located above the moulded line of the bottom shell plating nowhere less than the distance h as specified below:

Ch 11, Sec 21, Tab 1

Replace the row "9" as follows:

Table 1 : Documents to be submitted

No.	A/I **(1)**	Document	Document details
9	I	Reports related to test programs for type approval, gas analysis, factory test and onboard tests	

Ch 11, Sec 21, [3.1.1]

Add the following Note 1 at the end of the requirement:

Note 1: The risk of release of toxic or explosive gases is to be assessed based on the gas analysis performed during the battery pack prototype testing, as required by [5.3.4].

Ch 11, Sec 21, [3.1.2]

Replace the first paragraph by the following one:

It should not be possible to have sea water entering battery compartment under normal operating conditions.

Ch 11, Sec 21, [3.1]

Replace requirement [3.1.5] by the following one:

3.1.5 Fire protection

a) For the purpose of Part C, Chapter 4, battery rooms are to be regarded as:

- auxiliary machinery spaces of moderate fire risk i.e. cat(11) on passenger ships carrying more than 36 passengers
- other machinery spaces i.e. cat(7) on other ships

The boundary between two battery rooms is to have at least A-0 fire integrity.

In addition, the safety measures detailed in item b) to item d) are to be applied.

b) The boundaries between battery rooms containing Lithium-type batteries and machinery spaces of category A are to have A-60 fire integrity. The boundaries between battery rooms containing Lithium-type batteries and other rooms are to have the fire integrity required between a machinery space of category A and that other room.

c) A fixed fire detection system complying with the requirements of Pt C, Ch 4, Sec 15, [8] is to be provided in battery rooms. Combined heat and smoke detection is to be installed in battery rooms for Lithium-type batteries.

d) Battery rooms are to be fitted with a fixed fire-extinguishing system according to Pt C, Ch 4, Sec 6, [3.1]. This system is to be compatible with the technology of the battery employed, according to the battery manufacturer specification.

Ch 11, Sec 21, [3.2.5]

Replace the last bullet of the bulleted list by the following one:

- risk for external ingress (fire, fluid leakage, fire-fighting water…).

Ch 11, Sec 21, [5.1]

Replace requirement [5.1.3] as follows:

5.1.3 Prototype tests

The following items, at least, are to be checked:

a) External short circuit

b) Impact / Crush

c) Drop

d) Thermal abuse / Thermal cycling

e) Overcharge

f) Forced discharge

g) Internal short circuit

h) Insulation tests (High voltage test and insulation resistance test)

Ch 11, Sec 21, [5.3]

Insert the following new requirement [5.3.4]:

5.3.4 Gas analysis

The types and quantities of gases released by the cell when submitted to the propagation/internal test required in [5.3.3], item a) are to be measured and recorded. This gas analysis will be used as an input for the risk analysis required in [3.2.4] and the design of the battery compartment, see [3.1].

Ch 11, Sec 21, [5.3.4]

Add the following Note 2 in the existing requirement [5.3.4]:

Note 2: When this test is impractical at the factory, the following alternative may be considered:

- a calculation based on a method validated by tests is to be submitted to the Society, and
- Proper working of the cooling circuit is to be checked after installation onboard, see [5.3.6].

Ch 11, Sec 21, [5.3.5]

Add the following new item at the end of the bulleted list, in the existing requirement [5.3.5]:

- Temperature rise test in order to check the proper working of the cooling circuit, when direct cooling is provided and when the cooling test has not been performed during factory acceptance tests, see [5.3.5], Note 2.

Ch 11, Sec 23, [2.4]

Replace requirement [2.4.3] by the following one:

2.4.3 In addition to [2.4.1], for testing purpose, the speed of the chain cable during hoisting of the anchor and cable is to be measured over 37,5 m of chain cable and initially with at least 120 m of chain and the anchor submerged and hanging free. The mean speed of the chain cable during hoisting of the anchor from the depth of 120 m to the depth of 82,5 m is to be at least 4,5 m/min.

Where the available water depth is insufficient, an equivalent test method, compensating the missing hanging chain weight, is to be submitted for special examination by the Society. In case the test method is not considered equivalent, the maximum water depth associated to the additional class notation **UNSHELTERED ANCHORING** is to be limited to the tested depth and specified in a memoranda.

Ch 11, Sec 26

Replace Section 26 by:

SECTION 26 ULTRA-LOW EMISSION VESSEL (ULEV)

Symbols

n : Engine speed, in r/min

n_{hi} : Engine high speed, i.e. highest engine speed where 70% of the maximum power occurs

n_{lo} : Engine low speed, i.e. lowest engine speed where 50% of the maximum power occurs

n_{max} : 100% speed for the corresponding test cycle

P : Engine power, in kW

P_{max} : Maximum power in kW as designed by the engine manufacturer.

1 General

1.1 Scope

1.1.1 This Section applies to ships fitted with internal combustion engines having the capacity to emit gaseous pollutants and particular pollutants at a very low level at the time of assignment of **ULEV** additional class notation. The engines may have the capacity to emit a low level of pollutants in a specific operating mode only, hereafter referred to as "ULEV Mode".

The assignment of **ULEV** additional class notation as defined in Pt A, Ch 1, Sec 2, [6.8.15] is based on the information provided for each engine according to the requirements of this Section.

When granting **ULEV** additional class notation, a memoranda is to be endorsed in order to record the list of engines covered, the fuel(s) with which they have been tested and their ULEV mode if any.

1.2 Application

1.2.1 Engines

All internal combustion engines installed on board are to be in compliance with the requirements of this Section, except:

- engines intended to be used only for emergencies, or solely to power any device or equipment intended to be used only for emergencies on the ship on which it is installed, or engines installed in lifeboats intended to be used only for emergency
- engines with a power equal to or less than 110 kW.

1.2.2 **ULEV** additional class notation may be assigned to sea-going ships. The requirements of this Section do not apply to vessels dedicated to operations on inland waterways (including estuaries, rivers, estuary and lakes) falling into the scope of EU Regulation 2016/1628.

1.2.3 **ULEV** additional class notation may be assigned to new constructions or to ships in service as long as the engines installed on board, defined in [1.2.1], comply with the requirements of this Section.

1.3 Documents to be submitted

1.3.1 The documents listed in Tab 1 are to be submitted:

- Documents 1 to 8, as applicable, for each engine, including the after-treatment system if installed
- Documents 9 and 10, as applicable, for the whole ship.

Table 1 : Documents to be submitted

No.	Item	I/A
1	For each engine: Engine particulars, including exhaust after-treatment system particulars (e.g. Data sheet with general engine information, details of parameters, including engine components, settings and fuel specifications, that may influence the emissions of pollutants, Project Guide, Marine Installation Manual or installation recommendations)	I
2	If applicable, diagram of the reagent dosing system and associated control system	I
3	For each engine: Emission monitoring system specification, if applicable	I
4	For each engine or parent engine: Emission test program	I
5	For each engine or parent engine: Emission test report	A
6	For each engine's test report: If applicable, definition of the engine family and parent engine, and justification for the selection of the parent engine	A
7	For each engine: Accreditation certificate of the testing laboratory or other document showing compliance with [4.2.2]	I
8	For each engine: Engine maintenance manual, including after-treatment system maintenance manual	I
9	List of all engines installed on board including their purpose and serial number	A
10	General arrangement of the engine, exhaust piping and exhaust after-treatment system on the leadership, if applicable, and on the ULEV sistership	I
Note 1: I: For information; A: For approval		

2 Definitions

2.1

2.1.1 "Auxiliary engine" means an engine that does not directly or indirectly provide propulsion.

2.1.2 "Emission control system" means any device, system or element of design that controls or reduces emissions.

2.1.3 "Engine type" means a group of engines which do not differ in essential engine characteristics.

2.1.4 "Engine family" means a manufacturer's grouping of engine types which, through their design, have similar exhaust emission characteristics, and respect the applicable emission limit values.

2.1.5 "Engine operating mode" means a configuration of the engine control system.

2.1.6 "Gaseous pollutants" means the following pollutants in their gaseous state emitted by an engine: carbon monoxide (CO), total hydrocarbons (HC) and oxides of nitrogen (NO_X); NO_X being nitric oxide (NO) and nitrogen dioxide (NO_2), expressed as NO_2 equivalent.

2.1.7 "Internal combustion engine" or "engine" includes, where they have been installed, the emission control system and the communication interface (hardware and messages) between the engine's electronic control unit(s) and any other powertrain or machinery control unit necessary to comply with the requirements of this notation.

2.1.8 "NO_X Control Diagnostic system (NCD)" means a system on board the engine which has the capability of detecting a NO_X Control Malfunction, and identifying its likely cause by means of information stored in computer memory.

2.1.9 "Parent engine" means an engine type selected from an engine family in such a way that its emissions characteristics are representative of that engine family.

2.1.10 "Particle number" or "PN" means the number of solid particles emitted by an engine with a diameter greater than 23 nm.

2.1.11 "Particulate Control Diagnostic system (PCD)" means a system on board the engine which has a capability of detecting a Particulate Control Malfunction and identifying its likely cause by means of information stored in computer memory.

2.1.12 "Particulate matter" or "PM" means the mass of any material in the gas emitted by an engine that is collected on a specified filter medium after diluting the gas with clean filtered air so that the temperature does not exceed 325 K (52°C).

2.1.13 "Particulate pollutants" means any matter emitted by an engine that is measured as PM or PN.

2.1.14 "Propulsion engine" means any engine other than an auxiliary engine.

2.1.15 "ULEV sister ship" means a sister ship as defined in Pt B, Ch 1, Sec 2, [3.23.1]. Especially, it means that the engines and emission control system types and arrangement on board are identical to that on the leader ship.

3 Requirements for ULEV additional class notation

3.1 Requirements for the engines

3.1.1 Engine testing and design

Compliance with the requirements of [3.2] is to be demonstrated through testing of an engine type as per [4].

Note 1: Engines type-approved in the scope of EU regulation 2016/1628 may be accepted without further testing, provided that satisfactory documentation is submitted to the Society.

3.1.2 Testing on a parent engine may be accepted to demonstrate that the whole engine family complies with the requirements of [3.2]. For this purpose, the parent engine is to be selected by the engine manufacturer, such that the parent engine incorporates those features that will most adversely affect the pollutant emission level. This engine, in general is to have the highest gaseous and particulate pollutant emission level among all of the engines in the engine family.

Parent engine and engine family are to be defined taking into account the emission control system where fitted.

3.1.3 It may be considered by the Society that satisfactory measurements performed on the leader ship cover the engines installed on an ULEV sister ship, provided the engines, exhaust lines and emission control systems are documented as identical to the types of the ULEV sister ship.

3.2 Emission levels

3.2.1 The emissions of each engine installed on board are to be shown to remain below the thresholds given in Tab 2, based on measurements as detailed in [4]:

Table 2 : Maximum emission levels for ULEV additional class notation

Power range **(1)**	CO	HC **(2)**	NO_X	PM mass	PN
kW	g/kWh				#/kWh
$110 \le P < 130$	5,00	($HC + NO_X \le 5,40$)		0,14	–
$130 \le P < 300$	3,50	1,00	2,10	0,10	–
$P \ge 300$	3,50	0,19	1,80	0,015	10^{12}

(1) P is the engine power, in kW

(2) For gas fuelled engines and dual fuel engines in gas mode, the maximum allowable HC emission level is to be taken as the lower of:

- 6,19 and
- 0,19 + (9 × GER))

Where GER is the average gas energy ratio over the test cycle defined in [4.2.5].

3.3 Emission control monitoring

3.3.1 NO_X control monitoring

Electronically controlled engines using electronic control either to determine both the quantity and timing of injecting fuel; or to activate, de-activate or modulate the emission control system used to reduce NO_X are to be equipped with a NO_X Control Diagnostic system (NCD) able to identify the NO_X control malfunctions and their likely causes.

The NCD system is to conclude within 60 minutes of engine operation whether a detectable malfunction is present and, in this case, it is to trigger a visual alarm in the engine control room. It is to be possible to identify which malfunction has been detected.

The NCD system is to record each NO_X control malfunction under a specific code and store it in the onboard computer.

Note 1: A NO_X control malfunction is an attempt to tamper with the NO_X control system of an engine or a malfunction affecting that system that might be due to tampering. NO_X control malfunctions include:

- Impeded exhaust gas recirculation (EGR) valve, and
- Failures of the NO_X Control Diagnostic (NCD) system.

3.3.2 NO_X reagent monitoring

When the NO_X control emission includes the use of a reagent, the following parameters are to be monitored:

- level of reagent in the reagent tank
- reagent quality or concentration, or NO_X concentration
- interruption of reagent dosing.

Inadequate values of these parameters are to trigger a distinct visual alarm in the engine control room. Related incidents are to be recorded in the onboard computer.

3.3.3 Particulate control monitoring

Engines fitted with a particulate after-treatment system are to be equipped with a Particulate Control Diagnostic system (PCD) able to identify the particulate after-treatment system malfunctions.

In cases where the NO_X control system and the particulate control system share the same physical components (e.g. same substrate, same exhaust gas temperature sensor), these components may be monitored by the NO_X Control Diagnostic system only.

The PCD system is to conclude within the periods of engine operation detailed in Tab 3 whether a detectable malfunction is present and, in this case, it is to trigger a visual alarm in the engine control room. It is to be possible to identify which malfunction has been detected.

The PCD system is to record each particulate control malfunction under a specific code and store it in the onboard computer.

Note 1: A Particulate Control Malfunction is an attempt to tamper with the particulate after-treatment system of an engine or a malfunction affecting the particulate after-treatment system that might be due to tampering. Particulate Control Malfunctions include the types detailed in Tab 3.

Table 3 : Particulate after-treatment system malfunction types and corresponding period within which they are to be detected

Malfunction type	Period of engine operation within which the malfunction is to be detected and stored
Removal of the particulate after-treatment system	60 minutes of non-idle engine operation
Loss of function of the particulate after-treatment system	240 minutes of non-idle engine operation
Failures of the PCD system	60 minutes of engine operation

3.4 ULEV Mode

3.4.1 Engines with several operating modes are to comply with the requirements of [3.2] in at least one operating mode. The operating mode complying with the requirements of [3.2] is hereafter referred to as “the ULEV mode”.

3.4.2 The ULEV mode is to be clearly identified in the engine manual and/or shipboard manual and it is to be possible to record when the engine is operating in the ULEV mode or not.

4 Emission measurements

4.1 Pollutants to be measured

4.1.1 The brake specific emissions of the following pollutants, in g/kWh, are to be measured over the test cycle defined in [4.2.5]:

- Oxides of nitrogen, NO_X
- Hydrocarbons, expressed as total hydrocarbons, HC or THC
- Carbon monoxide, CO
- Particulate matter, PM
- Particle number, PN
- Carbon dioxide, CO_2.

Note 1: Carbon dioxide emissions are to be measured for information only.

4.2 Measurements

4.2.1 General

Measurements of the required pollutants are to be carried out according to the requirements of ISO 8178 series or to similar recognized standards or measurement methodologies deemed acceptable by the Society.

4.2.2 Measurements are to be carried out by a testing laboratory holding an accreditation certificate to ISO/IEC 17025 covering testing methods for the measurement of the required pollutants, which is issued by a national accreditation body.

Note 1: Measurements carried out by, or under the responsibility of, an organisation or body designated as a technical service as defined by EU Regulation 2016/1628 may also be accepted.

4.2.3 Measurements may be carried out on board or at a testing facility.

4.2.4 Measurements of each of the required pollutants are to be carried out during the same trial. Each engine subject to measurement is to be tested separately.

4.2.5 Cycle definition

B-Type test cycles as detailed in ISO 8178-4 are to be applied according to the type and operational speed of each engine, as defined in Tab 4.

Table 4 : B-type ISO 8178 test cycles to be applied

	Variable speed engine	Constant speed engine
Propulsion engine	E3	E2
Auxiliary engine	C1	D2

4.2.6 As a complement, for electronically controlled engines using electronic control to determine both the quantity and timing of injecting fuel or using electronic control to activate, de- activate or modulate the emission control system used to reduce NO_X, emission measurements are to be carried out at control points chosen randomly within the engine control area detailed in [4.5]. The number of control points is detailed in Tab 5.

The brake specific emissions of NO_X, HC, CO, PM and PN measured at each individual control point are not to exceed the limits given in Tab 2, multiplied by 2.

Table 5 : Number of control points according to the purpose and operation of the engine

	Variable speed engine	Constant speed engine
Propulsion engine	2	1
Auxiliary engine	3	1

4.2.7 Crankcase emissions

All crankcase emissions, including emissions normally routed into the exhaust after-treatment system and emissions normally discharged to the ambient atmosphere, are to be routed into the emissions sampling system for measurement purposes. Alternatively crankcase emissions may be added by calculation.

4.3 Fuel specification

4.3.1 For oil-fuelled engines, emission measurements as per [4.2] are to be carried out with the engine running on a fuel complying with ISO 8217 and with the engine manufacturer's specification.

4.3.2 For engines fuelled with natural gas, emission measurements as per [4.2] are to be carried out with the engine running successively on the reference fuels G_R and G_{20}, without any manual readjustment to the engine fuelling system between the two tests. One adaptation run is permitted after the change of the fuel. The composition of the reference fuels G_R and G_{20} are detailed in Tab 6 and Tab 7.

Note 1: In case where the reference fuels G_R and G_{20} are not available, emission measurements carried out with the engine running on two fuels with a composition different from that of G_R or G_{20} may be accepted provided that:

- The gas fuel compositions comply with the specification of the engine manufacturer, and
- The impact of the composition of the gas fuel is properly documented based on e.g. test reports and engineering analysis, to the satisfaction of the Society.

Table 6 : Composition of the reference fuel G_R

Property	Unit	min.	max.
Molar fraction of methane	mol %	84	89
Molar fraction of ethane	mol %	11	15
Molar fraction of other components (N_2, C_2+, other inert components)	mol %	–	1
Mass concentration of sulphur	mg/m^3	–	10

Table 7 : Composition of the reference fuel G_{20}

Property	Unit	min.	max.
Molar fraction of methane	mol %	99	100
Molar fraction of nitrogen	mol %	–	–
Molar fraction of other components (C_2, C_2+, other inert components)	mol %	–	1
Mass concentration of sulphur	mg/m^3	–	10

4.3.3 For engines fuelled with other fuels, emission measurements as per [4.2] are to be carried out with the engine running on fuels complying with the requirements of ISO 8178-5 or of a similar recognized standard deemed acceptable by the Society.

4.3.4 The fuel composition and properties are to be detailed in the test report.

4.4 Deterioration factors

4.4.1 The values measured according to [4.2] are to be multiplied by the deterioration factors detailed in Tab 8 for the purpose of demonstrating compliance with the emission limits given in [3.2.1].

These deterioration factors need not be applied if the pollutant emission measurements are carried out on engines and after-treatment systems that have already been used for more than 10 000 hours.

Table 8 : Deterioration factors for ULEV additional class notation

Pollutant	CO	HC	NO_X	PM	PN
Deterioration factor	1,3	1,3	1,15	1,05	1,0

4.4.2 Alternatively, case-by-case deterioration factors may be established based on a suitable testing program accounting for ageing of the engine and exhaust after-treatment system during 10 000 hours.

Figure 1 : Control area for variable speed auxiliary engines

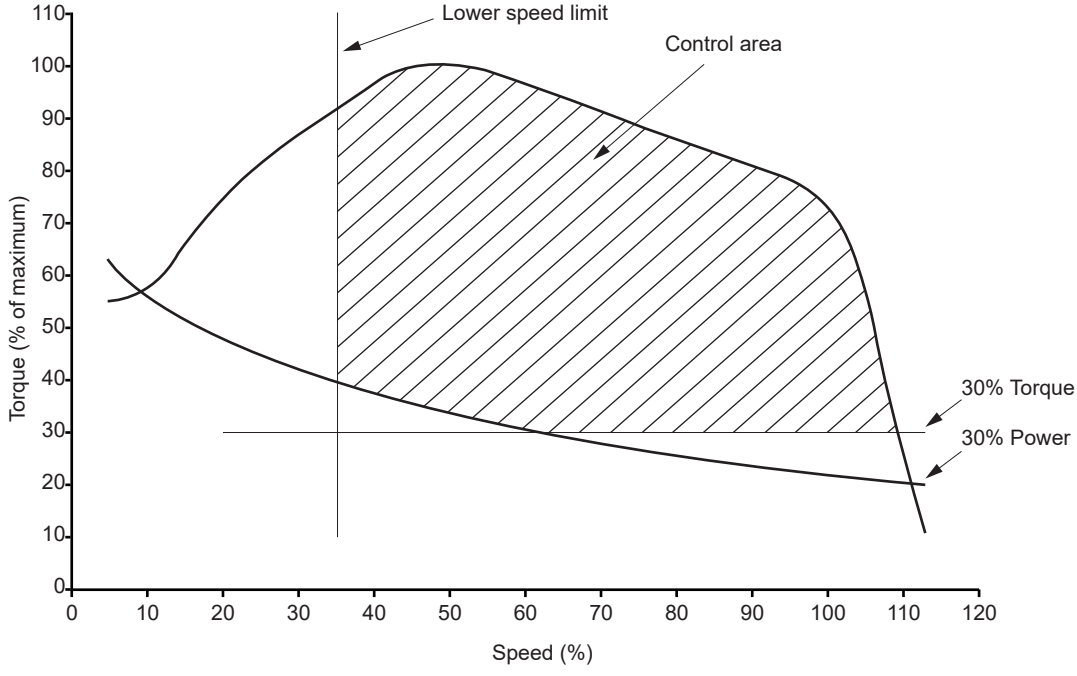
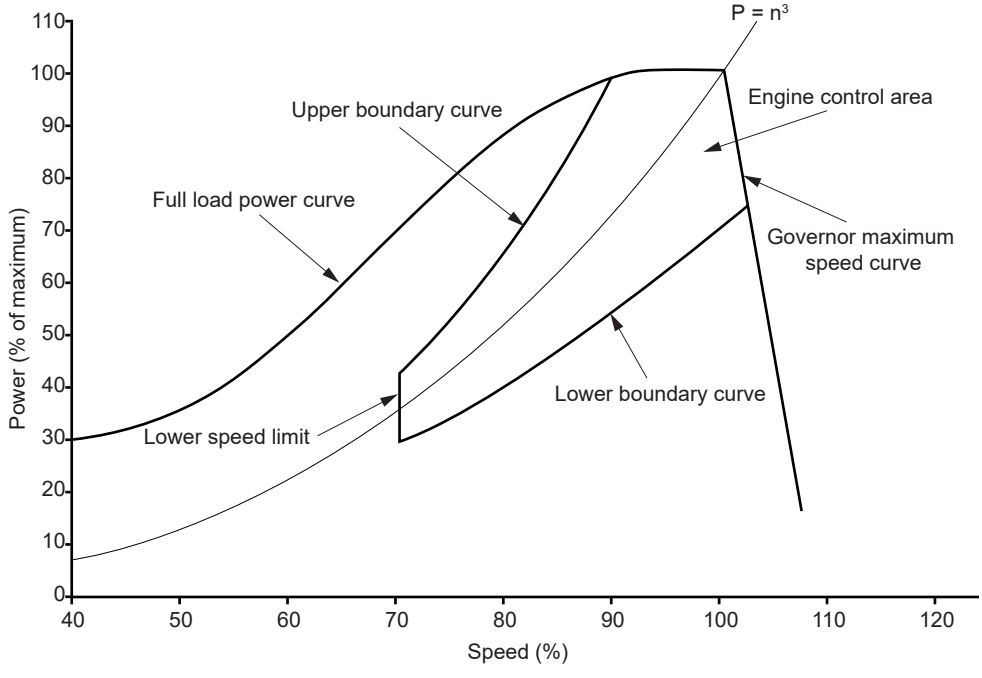


Figure 2 : Control area for variable speed propulsion engine



4.5 Control areas

4.5.1 Control area for variable speed auxiliary engines

The control area for variable speed auxiliary engines is delimited by the following curves (See Fig 1):

- upper torque limit:
  engine full load torque curve
- lower torque limit:
  30% of maximum torque
- lower speed limit:
  $n_{lo} + 0,15 \times (n_{hi} - n_{lo})$
- upper speed limit:
  n_{hi}
- points below 30% of maximum net power are excluded from the control area.

In addition, for engines with maximum net power < 300kW and for particulate matter only, the following areas are excluded from the control area:

- if $n_C < 2\ 400$ r/min, points to the right of or below the line formed by connecting the points of 30% of maximum torque or 30% of maximum net power, whichever is greater, at n_B and 70% of maximum net power at n_{hi}
- if $n_C \geq 2\ 400$ r/min, points to the right of the line formed by connecting the points of 30% of maximum torque or 30% of maximum net power, whichever is greater, at n_B, 50% of maximum net power at 2400 r/min, and 70% of maximum net power at n_{hi}

where:

$n_B = n_{lo} + 0,5 \times (n_{hi} - n_{lo})$

$n_C = n_{lo} + 0,75 \times (n_{hi} - n_{lo})$

4.5.2 Control area for variable speed propulsion engines

The control area for variable speed propulsion engines is defined as follows (See Fig 2):

- lower speed limit:
  $0,7 \times n_{max}$
- upper boundary curve:
  $P/P_{max} = 1,45\ (n/n_{max})^{3,5}$
- lower boundary curve:
  $P/P_{max} = 0,7 \times (n/n_{max})^{2,5}$
- upper power limit:
  full load power curve
- upper speed limit:
  maximum speed permitted by governor.

4.5.3 Control area for constant speed propulsion and auxiliary engines

The control area for constant speed engines is defined as:

- speed: 100%
- torque range: between 50% and 100% of the torque corresponding to the engine maximum power.

5 Onboard surveys

5.1 Initial survey

5.1.1 An onboard survey is to be undertaken by the Surveyor before granting **ULEV** additional class notation in order to check that the general arrangement and engine particulars are consistent with the submitted documents. In particular, the proper operation of the NCD and PCD systems including the associated alarms and the proper operation of recording of the status of engines when operated in the ULEV mode are to be checked in the presence of the Surveyor.

Ch 11, Sec 30, [3.7.9]

Replace item a) of the alphanumeric list by the following one:

a) Loading conditions

The following loading conditions are to be considered:

FH : Loading condition defined in NR625, Ch 4, Sec 8, [4.1] with any one cargo hold flooded up to the maximum flooding level.

BLF : Loading condition defined in NR625, Ch 4, Sec 8, [4.1] under the assumption that the water contained in the cargo hold when flooded has been drained and transferred to the holding tanks detailed in [3.7.6].

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