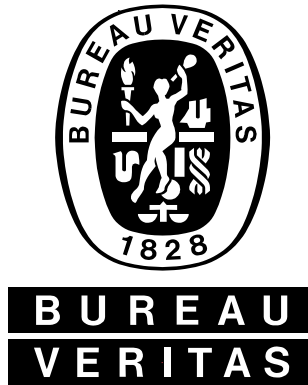




Rules for the Classification of Steel Ships

PART E – Service Notations for Offshore Service Vessels and Tugs

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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 the above listed being relieved from any of their expressed or implied obligations as a result of the interventions of the Society.
- 1.4** Only the Society 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 ("Applicable Referential"), 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 (or Certification as defined in clause 2.2) is an appraisalment 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 and/or to Applicable Referential 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 (available online on veristar.com), guidance notes 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 Rules and/or 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, and/or to the Applicable Referential, 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 safety 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 appraisalment 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 nor on its content in the event of the actual issuance of a Certificate. This opinion shall only be an appraisalment 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, involves, 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, interest 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 resolve 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-cent (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** The Services shall be automatically and immediately terminated in the event the Client can no longer establish any form of interest in the Unit (e.g. sale, scrapping).
- 9.3** 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, or immediately in the event of termination under clause 9.2, subject to compliance with clause 4.1 and 6 above.
- 9.4** 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, will be 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, other 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 the written 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 in accordance with and governed by the laws of England and Wales.
- 15.2** Any dispute shall be finally 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.
- 15.3** Notwithstanding clause 15.2, disputes relating to the payment of the Society's invoices may be submitted by the Society to the *Tribunal de Commerce de Nanterre*, France, or to any other competent local Court, at the Society's entire discretion.

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 and, when applicable, Business Partner Code of Conduct both available at <https://group.bureauveritas.com/group/corporate-social-responsibility/operational-excellence>.





RULES FOR THE CLASSIFICATION OF SHIPS

Part E Service Notations for Offshore Service Vessels and Tugs

Chapters **1 2 3 4 5 6 7 8 9 10 11 12**

Chapter 1	TUGS
Chapter 2	ANCHOR HANDLING VESSELS
Chapter 3	SUPPLY VESSELS
Chapter 4	FIRE FIGHTING SHIPS
Chapter 5	OIL RECOVERY SHIPS
Chapter 6	CABLE-LAYING SHIPS
Chapter 7	DIVING SUPPORT VESSELS
Chapter 8	LIFTING UNITS
Chapter 9	SEMI-SUBMERSIBLE CARGO SHIPS
Chapter 10	STANDBY RESCUE VESSELS
Chapter 11	ACCOMMODATION UNITS
Chapter 12	PIPE LAYING UNITS

The English wording of these rules take precedence over editions in other languages.

Unless otherwise specified, these rules apply to ships for which contracts are signed after July 1st, 2021. The Society may refer to the contents hereof before July 1st, 2021, as and when deemed necessary or appropriate.

CHAPTER 1

TUGS

Section 1 General

1	General	33
1.1	Application	
2	Definitions	33
2.1	Design bollard pull	
2.2	Reference towline force	
2.3	Design load	
2.4	Winch brake holding load	
2.5	Towline breaking strength	
2.6	Escort tugs indirect towing modes	
2.7	Escort forces and speed	
2.8	Towing winch emergency release systems	
3	Fire safety	36
3.1	Suppression of fire	

Section 2 Stability

1	Application	37
1.1		
2	General requirements	37
2.1	Openings	
2.2	Stability booklet	
2.3	Intact stability	
3	Additional requirements for escort tugs	39
3.1	Intact stability	
3.2	Stability booklet	
3.3	Inclinometer	

Section 3 Hull Structure

1	General	41
1.1	Application	
1.2	Documents to be submitted	
2	General requirements	41
2.1	Typical design arrangements	
2.2	Structure design principles	
2.3	Hull scantlings	
2.4	Other structures	
2.5	Rudder and bulwarks	
2.6	Anchoring and mooring equipment	
2.7	Towing equipment	

3	Additional requirements for escort tugs	46
3.1	Structural design principles	
3.2	Equipment for escort operations	
4	Additional requirements for salvage tugs	48
4.1	Equipment	

Section 4 Integrated Tug/Barge Combination

1	General	50
1.1	Application	
1.2	Permanent connections	
1.3	Removable connections	
1.4	Documents to be submitted	
2	General arrangement design	50
2.1	Bulkhead arrangement	
3	Integrated tug/barge combinations with permanent connection: stability, freeboard, design loads, hull scantlings and equipment	51
3.1	Stability calculations	
3.2	Freeboard calculation	
3.3	Still water hull girder loads	
3.4	Wave hull girder loads	
3.5	Still water local loads	
3.6	Wave local loads	
3.7	Hull girder strength	
3.8	Scantlings of plating, ordinary stiffeners and primary supporting members	
3.9	Equipment	
4	Integrated tug/barge combination with removable connection: stability, freeboard, design loads, hull scantlings and equipment	52
4.1	Stability calculations	
4.2	Freeboard calculation	
4.3	Still water hull girder loads	
4.4	Wave hull girder loads	
4.5	Still water local loads	
4.6	Wave local loads	
4.7	Hull girder strength	
4.8	Scantlings of plating, ordinary stiffeners and primary supporting members	
4.9	Equipment	
5	Connection	53
5.1	General	
5.2	Scantlings	
6	Other structures	53
6.1	Tug fore part	
6.2	Tug aft part	
6.3	Barge fore part	
6.4	Barge aft part	
7	Hull outfitting	54
7.1	Rudder and steering gear	

8	Construction and testing	54
8.1	Test of the disconnection procedure of removable connection	

Section 5 Testing

1	General	55
1.1	Application	
2	General requirements	55
2.1	Bollard Pull test	
2.2	Towing winches	
2.3	Towing hooks	
2.4	Emergency release system	
3	Additional requirements for escort tugs	56
3.1	Escort performance simulations	
3.2	Escort performance trials	
3.3	Escort equipment testing	

Appendix 1 Bollard Pull Trials

1	General	59
1.1	Purpose	
1.2	Application	
2	General requirements	59
2.1	Bollard pull trial	
2.2	Bollard pull trial conditions	
2.3	Engine rating	
2.4	Steady state phase	
3	Requirements for the trial site	60
3.1	Water depth and radius	
3.2	Ship to shore distance	
3.3	Current	
3.4	Water density	
3.5	Waves	
3.6	Wind	
3.7	Outside temperature	
3.8	Towline	
3.9	Vessel orientation relative to the quay	
4	Instrumentation	62
4.1	Load cell	
4.2	Engine speed measurement	
4.3	Power measurement	
4.4	Data logging	
5	Trial preparation	64
5.1	Draught and trim	
5.2	Propellers	
5.3	Fuel	

6	Trial execution	65
6.1	General	
6.2	Steps to be performed	
7	Data analysis	65
7.1	Validation of recorded data	
7.2	Identification of steady state performance	
8	Reporting	65
8.1	Trial report requirements	
9	Part load bollard pull re-evaluation trials	66
9.1	Application	
9.2	Trial overview	
9.3	Prerequisites	
9.4	Step 1: Evaluation of engine power	
9.5	Step 2: Re-evaluation of propulsion efficiency	
9.6	Step 3: Re-evaluation of bollard pull capability at available power	
9.7	Presentation of results	

CHAPTER 2

ANCHOR HANDLING VESSELS

Section 1 General

1	General	71
1.1	Application	
1.2	Definitions	

Section 2 General Arrangement

1	General	72
1.1	Access to machinery space and spaces below the exposed cargo deck	

Section 3 Stability

1	General	73
1.1	Assumptions	
1.2	Definitions	
1.3	Heeling moment	
1.4	Permissible tension	
1.5	Calculation of stability curves	
1.6	Intact stability	
1.7	Information to be displayed	
1.8	Stability booklet	
1.9	Stability instrument	

Section 4 Hull Structure

1	Documentation	79
1.1	Documents to be submitted	
2	General requirements	80
2.1	Deck equipment	
2.2	Loading manual	
2.3	Design loads	
2.4	Deck structure	
2.5	Anchor handling winch	
2.6	Anchor handling deck equipment other than winches	
2.7	Stern roller	
2.8	Wire	
2.9	Anchor handling arrangements	

Section 5 Testing

1	General	82
1.1	Load test	
1.2	Functional test	
1.3	Operational tests	

CHAPTER 3

SUPPLY VESSELS

Section 1 General

1	General	85
1.1	Application	
1.2	IMO regulations	
1.3	Classification notations	
1.4	Applicable rules	
1.5	Definitions	
2	Documents to be submitted	89
2.1	General	

Section 2 General Arrangement

1	Compartment arrangement	91
1.1	General	
1.2	Additional requirements for ships granted with HNLS and/or WELLSTIM additional service features	
1.3	Compartment arrangement in way of oil product cargo tanks	
2	Arrangement and access to spaces	92
2.1	Access arrangement in way of cargo tanks for oil products	
2.2	Additional requirements for ships granted with HNLS and/or WELLSTIM additional service features	
3	Arrangement for hull and forecastle openings	93
3.1	General	

Section 3 Stability

1	General	94
1.1	Application	
1.2	Relaxation	
1.3	Additional requirements for ships granted with HNLS and/or WELLSTIM additional service features	
2	Intact stability	94
2.1	General	
2.2	Additional requirements for ships granted with HNLS and/or WELLSTIM additional service features	
3	Damage stability	95
3.1	Damage stability when the additional class notation SDS is assigned	

Section 4 Hull Structure

1	Structure design principles	97
1.1	General	
1.2	Side structure exposed to bumping	
1.3	Deck structure	
1.4	Structure of cement tanks and mud compartments	
1.5	Additional requirements for ships granted with HNLS and/or WELLSTIM additional service features	
1.6	Additional requirements for ships granted with notation -acids	
2	Design loads	97
2.1	Dry uniform cargoes	
3	Hull scantlings	98
3.1	Plating	
3.2	Ordinary stiffeners	
3.3	Primary supporting members	
4	Other structure	98
4.1	Aft part	
4.2	Superstructures and deckhouses	
4.3	Structure of cargo tanks	
5	Hull outfitting	99
5.1	Rudders	
5.2	Bulwarks	
5.3	Equipment	

Section 5 Machinery and Cargo Systems

1	Machinery systems	100
1.1	Cargo heating systems	
1.2	Exhaust pipes	
1.3	Inert gas system	
1.4	Other machinery systems	
1.5	Additional requirements for ships granted with HNLS and/or WELLSTIM additional service features	
1.6	Additional requirements for ships granted with notations -FP≤60°C and/or -acids and/or -toxic	
1.7	Additional requirements for ships granted with notation -FP≤60°C	
1.8	Additional requirements for ships granted with notation -toxic	
1.9	Additional requirements for ships granted with notation -acids	
2	Cargo piping design	100
2.1	Cargo separation	
2.2	Design and materials	
2.3	Piping arrangement	
2.4	Additional requirements for ships granted with HNLS and/or WELLSTIM additional service features	
2.5	Additional requirements for ships granted with notations -FP≤60°C and/or -acids and/or -toxic	

3	Cargo tanks	101
3.1	Cargo oil tanks	
3.2	Additional requirements for ships granted with HNLS and/or WELLSTIM additional service features	
4	Cargo pumping system	101
4.1	General	
5	Cargo tank fittings	102
5.1	Level gauging systems and overflow control	
5.2	Cargo tank venting systems	
5.3	Additional requirements for ships granted with HNLS and/or WELLSTIM additional service features	
5.4	Additional requirements for ships granted with notation -toxic	
5.5	Additional requirements for ships granted with notation -acids	
6	Mechanical ventilation in the cargo area	103
6.1	Cargo pump-room ventilation	
6.2	Additional requirements for ships granted with HNLS and/or WELLSTIM additional service features	
7	Discharging and loading of portable tanks on board	103
7.1	Ships granted with additional service features HNLS and/or WELLSTIM	
8	Additional requirements for carriage of liquid carbon dioxide and liquid nitrogen	103
8.1	Ships granted with notation -LG	

Section 6 Electrical Installations, Instrumentation and Automation

1	Hazardous location and types of equipment	105
1.1	General	
2	Additional requirements for ships granted with HNLS and/or WELLSTIM additional service features	105
2.1	General	
2.2	Additional requirements for ships granted with notations -FP≤60°C and/or -toxic	
2.3	Additional requirements for ships granted with notation -acid	

Section 7 Fire Prevention, Protection and Extinction

1	General	106
1.1	Application	
2	Fire prevention and protection	106
2.1	Ships granted with additional service features HNLS and/or WELLSTIM	
3	Fire fighting	106
3.1	Ships carrying oil product	
3.2	Ships granted with additional service features HNLS and/or WELLSTIM	
4	Personnel protection	106
4.1	Ships carrying oil products	
4.2	Ships granted with additional service features HNLS and/or WELLSTIM	
4.3	Additional requirements for ships granted with notation -LG	

CHAPTER 4

FIRE FIGHTING SHIPS

Section 1 General

1	General	109
1.1	Application	

Section 2 Hull and Stability

1	Stability	110
1.1	Intact stability	
2	Structure design principles	110
2.1	Hull structure	
2.2	Water and foam monitors	
3	Other structures	110
3.1	Arrangement for hull and superstructure openings	

Section 3 Machinery and Systems

1	General	111
1.1	Application	
1.2	Documents to be submitted	
2	Design of machinery systems	111
2.1	Manoeuvrability	
2.2	Fuel oil capacity	
2.3	Scuppers	
3	General requirements for fire-fighting systems	112
3.1	General	
3.2	Independence of pumping and piping systems	
3.3	Design and construction of piping systems	
3.4	Monitors	
3.5	Monitor control	
4	Water fire-fighting system	113
4.1	Characteristics	
4.2	Monitors	
4.3	Piping	
5	Fixed foam fire-extinguishing system	114
5.1	General	
5.2	Characteristics	
5.3	Arrangement	
6	Portable fire-fighting equipment	114
6.1	Portable high expansion foam generator	
6.2	Hydrants and fire hoses	

7	Fire-fighter's outfits	114
	7.1 Number and characteristics	
	7.2 Compressed air system for breathing apparatuses	
8	Testing	115
	8.1 General	
	8.2 Workshop tests	
	8.3 On board tests	

Section 4 Fire Protection and Extinction

1	General	116
	1.1 Application	
	1.2 Documents to be submitted	
2	Fire protection of exposed surfaces	116
	2.1 Structural fire protection	
	2.2 Deadlights and shutters	
3	Self-protection water-spraying system	116
	3.1 General	
	3.2 Capacity	
	3.3 Arrangement	
	3.4 Pumps	
	3.5 Piping system and spray nozzles	

CHAPTER 5

OIL RECOVERY SHIPS

Section 1 General

1	General	121
1.1	Application	
1.2	Definitions	

Section 2 Hull and Stability

1	General	123
1.1	Documents to be submitted	
1.2	General arrangement	
2	Stability	124
2.1	Intact stability	
3	Hull scantlings	124
3.1	Additional loads	
4	Construction and testing	124
4.1	Testing	

Section 3 Machinery and Systems

1	General	125
1.1	Documents to be submitted	
2	Machinery installation and piping system other than oil recovery system	125
2.1	Sea water cooling system	
2.2	Water fire-extinguishing system	
2.3	Exhaust gas systems	
3	Pumping system, piping system and pump-rooms intended for recovered oil	125
3.1	Design of pumping and piping systems	
3.2	Arrangement of piping systems	
3.3	Oil recovery pumps	
3.4	Oil recovery pump-rooms	
4	Oil recovery tank fittings	126
4.1	Vent pipes	
4.2	Level gauging and overfilling control	
5	Heating systems	127
5.1		
6	Additional requirements	127
6.1	Ships assigned with the additional service feature OILTREAT	

Section 4 Electrical Installations

1	General	128
1.1	Application	
1.2	Documentation to be submitted	
2	Design requirements	128
2.1	System of supply	
2.2	Earth detection	
3	Hazardous locations and types of equipment	128
3.1	Electrical equipment permitted in hazardous areas	
3.2	Additional requirements for machinery installations in hazardous areas	
3.3	Openings, access and ventilation conditions affecting the extent of hazardous areas	

Section 5 Fire Protection, Detection and Extinction

1	General	130
1.1	Documents to be submitted	
2	Mechanical ventilation in the oil recovery area	130
2.1	General	
2.2	Ventilation of recovered oil pump rooms	
2.3	Ventilation of enclosed spaces normally entered during oil recovery operation other than recovery oil pump rooms	
3	Fire protection and fighting	130
3.1	Vapor detector	
3.2	Structural fire protection	
3.3	Fire-fighting	

CHAPTER 6

CABLE-LAYING SHIPS

Section 1 General

1	General	135
1.1	Application	

Section 2 Hull and Stability

1	General	136
1.1	Application	
1.2	Documents to be submitted	
2	Stability	136
2.1	Intact stability	
2.2	Damage stability for ships where the notation SDS has been required	
3	Hull scantlings	136
3.1	Cable tanks	
3.2	Connection of the machinery and equipment with the hull structure	
4	Other structures	137
4.1	Fore part	
5	Hull outfitting	137
5.1	Equipment	

Section 3 Machinery and Systems

1	General	138
1.1	Propulsion and manoeuvrability	
1.2	Documents to be submitted	
2	Arrangements for cable laying, hauling and repair	138
2.1	Typical machinery and equipment of cable laying ships	
2.2	Design of cable handling machinery and equipment	
2.3	Safety	
2.4	Testing of cable handling machinery and equipment	
3	On board trials	139
3.1	Ship trials	
3.2	Equipment trials	

Section 4 Fire Protection

1	Cable tanks	140
1.1	Means for fire fighting	

CHAPTER 7

DIVING SUPPORT VESSELS

Section 1 General

1	General	143
1.1	Application	
1.2	Scope	
2	Diving system	144
2.1	Description	
2.2	Classification of the diving system	
3	References	144
3.1	Acronyms	
3.2	Definitions	
3.3	Reference rules and regulations	
4	Documents to be submitted	146
4.1	General	
4.2	Diving system documentation	

Section 2 General Arrangement

1	General arrangement	148
1.1	Diving system arrangements	
1.2	Machinery spaces	
1.3	Hazardous areas	
1.4	Breathing gas storage	
1.5	Location of deck decompression chamber	
1.6	Diving operations	
2	Access arrangement	148
2.1	General	
2.2	Means of evacuation	

Section 3 Structural Assessment

1	Diving equipment foundations	149
1.1	General	
1.2	Design loads	
1.3	Allowable deflection	
2	Launching system foundations	149
2.1	General	

Section 4 Machinery and Systems

1	Sea inlets	150
	1.1 General	
2	Position keeping	150
	2.1 General	
	2.2 Dynamic positioning	
3	Electrical installations	150
	3.1 General	
	3.2 Electrical power supply	
4	Diving control station	151
	4.1 General	
	4.2 Communication and relocation system	
5	Diver heating system	151
	5.1 Oil fired heaters	

Section 5 Safety Features

1	Fire safety	152
	1.1 Personnel protection	
	1.2 Structural fire protection	
	1.3 Detection and alarm	
	1.4 Fire-fighting equipment	
2	Breathing gas system	153
	2.1 Storage on board	
	2.2 Piping	
	2.3 Oxygen installation	
	2.4 Colour code	
	2.5 Signboards	
3	Ventilation	154
	3.1 General	
4	Means of evacuation of the divers in saturation	154
	4.1 Application	
	4.2 Hyperbaric evacuation system	
	4.3 Launching arrangement	

Section 6 Specific Requirements for Ships Assigned with the Service Notation diving support-capable

1	General	155
	1.1 Application	
	1.2 Documents to be submitted	
	1.3 Activation of service notation diving support-portable	
2	General arrangement	156
	2.1 General	

3	Structural assessment	156
	3.1 General	
4	Machinery and systems	156
	4.1 Position keeping	
	4.2 Sea inlets	
5	Electrical installations and automations	156
	5.1 Electrical power supply	
6	Safety features	156
	6.1 Fire safety	
	6.2 Breathing gas facilities	
	6.3 Ventilation	

Section 7 Initial Inspection and Testing

1	General	157
	1.1 Application	
	1.2 Non-permanent diving system	
2	On-board testing	157
	2.1 Diving installations	

CHAPTER 8

LIFTING UNITS

Section 1 General

1	General	161
1.1	Application	
1.2	Scope	
2	Lifting equipment	161
2.1	Certification of the lifting equipment	
3	References	161
3.1	Acronyms	
3.2	Definitions	
4	Documents to be submitted	162
4.1	General	
4.2	Lifting equipment documentation	

Section 2 General Arrangement

1	General	164
1.1	Location of lifting appliances	
1.2	Position of the crane during navigation	

Section 3 Stability and Subdivision

1	General	165
1.1	Application	
1.2	Definitions	
1.3	Loading conditions	
1.4	Trim and stability booklet	
1.5	Model tests or direct calculations	
1.6	Operational procedures against capsizing	
1.7	Guidance on wind force	
2	Intact stability	167
2.1	General stability criteria	
2.2	Lifting operations conducted under environmental and operational limitations	
2.3	Intact stability criteria in the event of sudden loss of the lifted load	
3	Intact stability - alternative method	169
3.1	General	
3.2	Alternative stability criteria	
4	Additional intact stability criteria for crane overload test	169
4.1	General	

5	Alternative damage stability for lifting operations for ships where additional class notation SDS is assigned	170
5.1	Application	
5.2	Data to be submitted	
5.3	Extent of damage	
5.4	Alternative damage stability criteria	

Section 4 Structural Assessment

1	General	171
1.1	Application	
2	Hull girder strength	171
2.1	Principles	
2.2	Hull framing	
2.3	Hull girder loads	
3	Structural design principles	171
3.1	General	
3.2	Crane pedestal	
3.3	Mobile lifting equipment	
3.4	Devices for equipment stowage	
3.5	Connecting bolts	
4	Materials and welding	172
4.1	Structural category and steel grades for the foundations of the lifting equipment	
4.2	Welding	
5	Design loads	172
5.1	General	
5.2	Lifting loads	
5.3	Environmental loads	
5.4	Hull girder stress	
6	Loading conditions	173
6.1	General	
6.2	Load cases	
7	Allowable stress	173
7.1	General	
7.2	Criteria	
7.3	Basic allowable stress factor	
7.4	Material strength	
7.5	Equivalent stress	
8	Buckling	174
8.1	General	
8.2	Buckling strength criteria	
9	Fatigue	175
9.1	General	

Section 5 Machinery and Systems

1	General	176
	1.1 Essential service	
	1.2 Hazardous areas	
2	Position keeping	176
	2.1 General	
	2.2 Dynamic positioning	
3	Power supply	176
	3.1 General	
4	Lifting equipment controls	176
	4.1 General	
	4.2 Overload prevention	
	4.3 Emergency system	
	4.4 Communication means	

Section 6 Initial Inspection and Testing

1	General	177
	1.1 Application	
2	Onboard testing	177
	2.1 Lifting installations	

Section 7 Self-Elevating Ships

1	General	178
	1.1 Application	
	1.2 Applicable rules and regulations	
2	Classification principles	178
	2.1 Classification limits	
	2.2 Design criteria statement	
3	Definitions	179
	3.1 Self-elevating ship	
	3.2 Modes of operation	
	3.3 Water levels, crest elevation and water depth	
	3.4 Configuration of a self-elevating unit in elevated position	
4	Documents to be submitted	180
	4.1 General	
	4.2 Operating manual	
5	Structure design principles	181
	5.1 General	
6	Design conditions	181
	6.1 General	
	6.2 Design conditions in elevated configuration	
	6.3 Transit conditions	
	6.4 Installation conditions	

7	Structural analysis	181
	7.1 Structural analysis in elevated position	
	7.2 Structural analysis in transit conditions and installations conditions	
8	Jacking system	182
	8.1 General	
	8.2 Electricity and automation	
9	Fire and safety	182
	9.1 Firefighting water supply	
10	Construction survey	182
	10.1 Self-elevating system	

CHAPTER 9

SEMI-SUBMERSIBLE CARGO SHIPS

Section 1 General

1	General	185
1.1	Application	
1.2	Scope	
1.3	Definitions	
2	Documents to be submitted	186
2.1	General	
2.2	Submersion operating manual	

Section 2 General Arrangement

1	General	188
1.1	Draft marks	
2	Ballast system arrangement	188
2.1	General	
2.2	Central ballast control station	

Section 3 Stability, Subdivision and Load Line

1	General	189
1.1	Additional class notation SDS	
1.2	Loading instrument	
1.3	Stability verification in temporary submerged conditions	
1.4	Submersion procedure	
2	Loading conditions	189
2.1	Transit conditions	
2.2	Temporary submerged conditions	
3	Intact stability in transit conditions	189
3.1	General	
3.2	Buoyancy of the cargo	
4	Damage stability in transit conditions	190
4.1	General	
4.2	Buoyancy of the cargo	
4.3	Type B freeboard	
4.4	Type B-60 and B-100 freeboard	
5	Intact stability in temporary submerged conditions	191
5.1	Criteria	

6	Damage stability in temporary submerged conditions	191
6.1	General	
6.2	Extent of damage	
6.3	Compartment permeability	
6.4	Damage criteria	
6.5	Intermediate stage of flooding	
7	Temporary submersion	192
7.1	International Load Line Certificate	
7.2	Reserve buoyancy	
7.3	Watertight openings	
7.4	Openings	

Section 4 Hull Structure

1	General	193
1.1	Application	
1.2	Internal ballast pressure when using overflow tanks	
2	Loading conditions	193
2.1	General	
3	Design loads	193
3.1	Vertical wave bending moments	
3.2	Horizontal wave bending moments	
3.3	Ship motions and accelerations	
3.4	Vertical wave shear forces	
3.5	Still water and inertial pressures	
4	Hull girder strength	194
4.1	General	
5	Hull scantlings	194
5.1	General	
5.2	Structural models	
6	Connection of the buoyancy casings	194
6.1	General	
6.2	Design loads	
6.3	Strength criteria	
7	Fatigue strength assessment	194
7.1	General	

Section 5 Machinery and Systems

1	General	195
1.1	Sea pressure	
2	Ballast system	195
2.1	Failure modes and effects analysis	
2.2	Failure modes	
2.3	Definitions	

2.4	Safety principles	
2.5	Air pipes	
2.6	Overflow tanks	
2.7	Valves and actuators	
2.8	Pressurized ballast tanks	
2.9	Control and monitoring	
3	Scuppers and sanitary discharges	196
3.1	Arrangement of scuppers and sanitary discharges	

Section 6 Electrical Installations and Controls

1	Emergency source of power	197
1.1	Essential service	
2	Controls	197
2.1	Draft mark automatic gauges	
2.2	Ballast tanks gauging system	
2.3	Ballast valves monitoring	
2.4	Communication means	

Section 7 Safety Features

1	Fire safety	198
1.1	General	
1.2	Fire hydrants	
2	Means of escape	198
2.1	Transit conditions	
2.2	Temporary submerged conditions	
3	Life-saving appliances	198
3.1	Temporary submerged conditions	

Section 8 Initial Inspection and Testing

1	General	199
1.1	Application	
2	Commissioning	199
2.1	At quay	
2.2	Sea trials	

CHAPTER 10

STANDBY RESCUE VESSELS

Section 1 General

1	General	203
1.1	Application	
1.2	Documents to be submitted	

Section 2 Rescue Arrangement, Accommodation and Equipment

1	General	205
1.1	Wheelhouse	
2	Rescue equipment and facilities	205
2.1	Rescue zone	
2.2	Scrambling net	
2.3	Retrieval device	
2.4	Rescue hooks	
2.5	Fast Rescue Craft (FRC)	
2.6	Safety equipment	
2.7	Helicopter winching area	
3	Survivors spaces	206
3.1	General	
3.2	Decontamination area	
3.3	Reception area	
3.4	Treatment room	
3.5	Accommodations	
3.6	Non-survivors	
4	Medical equipment and supplies	206
4.1	Water	
4.2	Meals	
4.3	Sundries	
4.4	Medical equipment	

Section 3 Hull and Stability

1	Stability	207
1.1	General	
1.2	Additional requirements for towing operations	
1.3	Additional requirements for water spraying	
2	Hull	207
2.1	Vessels intended for towing operations	
2.2	Lifeboat towing	

Section 4

Machinery

1

General

208

1.1

Application

1.2

Ship propulsion and manoeuvrability

1.3

Exhaust pipes

Section 5

Electrical Installations

1

General

209

1.1

Electrical installations

1.2

Searchlight

Section 6

Fire Protection

1

General

210

1.1

Additional requirements for water spraying

CHAPTER 11

ACCOMMODATION UNITS

Section 1 General

1	General	213
1.1	Application	
1.2	Applicable rules	
1.3	Definitions	
2	Documents to be submitted	214
2.1	General	

Section 2 Electrical Installations and Automation

1	Interaction with operational ships or units	215
1.1	Application	
1.2	Emergency Shutdown	

Section 3 Fire Protection, Detection and Extinction

1	Interaction with operational ships or units	216
1.1	Application	
1.2	Structural integrity	
1.3	Installation layout	

Section 4 Specific Requirements for Ships Assigned with the Additional Service Feature SPxxx-capable

1	General	217
1.1	Application	
1.2	Documents to be submitted	
2	Design review	217
2.1	Specific requirements	
2.2	Stability assessment	
2.3	Safe Return to Port	

CHAPTER 12

PIPE LAYING UNITS

Section 1 General

1	General	221
1.1	Application	
1.2	Scope	
2	Pipe laying system	221
2.1	General	
2.2	Certification of the pipe laying equipment	
3	Documents to be submitted	222
3.1	General	
3.2	Pipe laying equipment documentation	

Section 2 Stability and Subdivision

1	General	223
1.1	Application	
1.2	Loading conditions	

Section 3 Structural assessment

1	General	224
1.1	Application	
2	Hull girder strength	224
2.1	Principles	
3	Materials and welding	224
3.1	Structural category and steel grades for the foundations of the pipe laying equipment	
4	Pipe laying equipment foundations	224
4.1	General	
4.2	Connecting bolts	

Section 4 Initial Inspection and Testing

1	General	225
1.1	Application	
2	Onboard testing	225
2.1	Pipe laying installations	

Part E

Service Notations for Offshore Service Vessels and Tugs

Chapter 1

TUGS

SECTION 1	GENERAL
SECTION 2	STABILITY
SECTION 3	HULL STRUCTURE
SECTION 4	INTEGRATED TUG/BARGE COMBINATION
SECTION 5	TESTING
APPENDIX 1	BOLLARD PULL TRIALS

SECTION 1GENERAL

1 General

1.1 Application

1.1.1 Ships complying with the requirements of this Chapter are eligible for the assignment of one of the following service notations:

- tug
- salvage tug
- escort tug

as defined in Pt A, Ch 1, Sec 2, [4.7].

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].

The service notation **escort tug** is always completed by the following additional service features:

- design maximum braking force = $[T_{x,MAX}/9,81]$ t
- design maximum escort speed = $[V_{MAX}]$ kn
- design maximum steering force = $[T_{y,MAX}/9,81]$ t

where the design maximum values are defined in [2.7].

Ships which are likely to operate at sea within specific limits may, under certain conditions, be granted an operating area notation. For the definition of operating area notation, reference is made to Pt A, Ch 1, Sec 2, [5.3].

1.1.2 Ships dealt with in this Chapter are to comply with:

- Part A of the Rules
- NR216 Materials and Welding

- applicable requirements according to Tab 1 and specific requirements for testing as detailed in Ch 1, Sec 5
- Ch 1, Sec 4 for tugs assigned with the additional service feature **barge combined**.

2 Definitions

2.1 Design bollard pull

2.1.1 The design bollard pull T_{BP} , in kN, is the maximum sustained towline force the tug is capable of generating at zero forward speed, to be initially specified by the Designer and to be verified by a full scale test, generally referred to as bollard pull test (see Ch 1, Sec 5, [2.1.1]).

2.1.2 Where the value of the design bollard pull is not provided, the following default values may be used for preliminary design review:

- $T_{BP} = 0,204 N P_S$
for conventional tugs with propellers fitted with nozzles, as described in Ch 1, Sec 3, [2.1.2]
- $T_{BP} = 0,176 N P_S$
for tractor tugs and ASD tugs with steerable propellers fitted with nozzles, as described in Ch 1, Sec 3, [2.1.3] and Ch 1, Sec 3, [2.1.4] respectively.

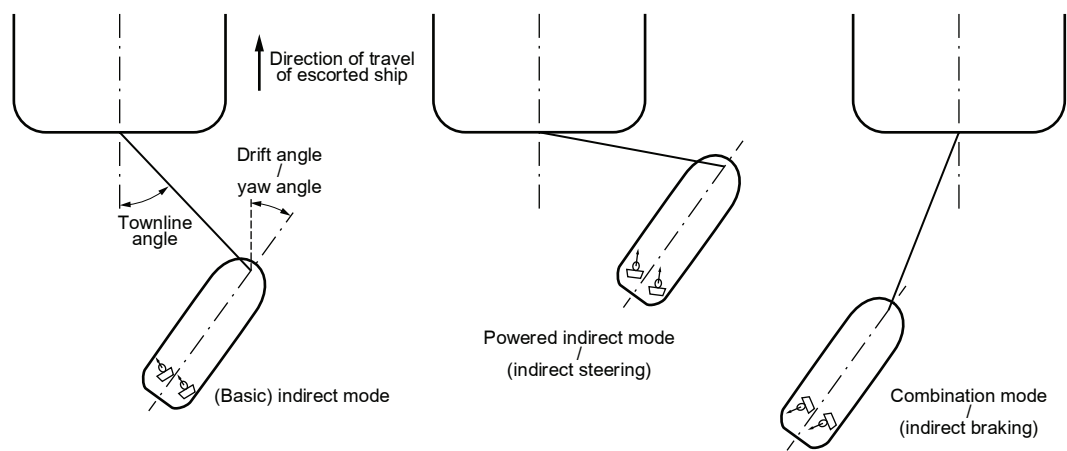
where:

- N : Number of propellers
- P_S : Maximum continuous power per propeller shaft, in kW.

Table 1 : Applicable requirements

Item		Greater than or equal to 500 GT	Less than 500 GT
Ship arrangement	L ≥ 90 m	• Part B	• NR566
	L < 90 m	• NR600	• NR566
Hull	L ≥ 90 m	• Part B • Ch 1, Sec 3	• Part B • Ch 1, Sec 3
	L < 90 m	• NR600 • Ch 1, Sec 3	• NR600 • Ch 1, Sec 3
Stability		• Part B • Ch 1, Sec 2	• NR566 • Ch 1, Sec 2
Machinery and cargo systems		• Part C	• NR566
Electrical installations		• Part C	• NR566
Automation		• Part C	• NR566
Fire protection, detection and extinction		• Part C	• NR566 • Article [3]
Note 1: NR566: Hull Arrangement, Stability and Systems for Ships less than 500 GT NR600: Hull Structure and Arrangement for the Classification of Cargo Ships less than 65 m and Non Cargo Ships less than 90 m.			

Figure 1 : Schematic overview of indirect towing modes (escort tug)



2.2 Reference towline force

2.2.1 The reference (quasi-static) towline force T , in kN, is considered to represent:

- the design bollard pull T_{BP} for service notations **tug** and **salvage tug**, see [2.1]
- the design maximum steady towline force $T_{ESC,MAX}$ for service notation **escort tug**, see [2.7].

2.3 Design load

2.3.1 The design load DL , in kN, is the force taken into consideration for the strength assessment and testing of the towing equipment and the associated supporting structures, and is to be taken as not less than:

$DL = DAF T_{BP}$

where:

DAF : Dynamic amplification factor taking into consideration dynamic effects.

Reference values for the DAF are given in:

- for service notations **tug** and **salvage tug**:
Ch 1, Sec 3, [2.7.2]
- for service notation **escort tug**:
Ch 1, Sec 3, [3.2.2].

2.4 Winch brake holding load

2.4.1 The winch brake holding load BHL , in kN, is the maximum towline force the towing winch can withstand without slipping of the (activated) brake, considering the towline at the first inner layer.

2.4.2 The BHL is a reference for the strength assessment and testing of towing winches and associated towing fittings (e.g. fairlead, staple, gob-eye) as well as their supporting structures.

2.5 Towline breaking strength

2.5.1 The towline breaking strength, in kN, is the tension required to cause failure of the towline (parting of the towline).

2.6 Escort tugs indirect towing modes

2.6.1 General

Escorting is considered to include active (emergency) steering, braking and otherwise controlling of the escorted ship by the tug operating in indirect towing mode, whereby the ahead speed of the escorted ship is within a typical speed range of 6 to 10 knots.

Escort tugs may work in different indirect towing modes, depending on the required action towards the escorted ship (e.g. steering, braking). The main indirect towing modes relevant for escort tugs are schematically shown in Fig 1.

Where reference is made to “indirect steering” the objective is to maximise the steering force in indirect towing mode.

Where reference is made to “indirect braking” the objective is to maximise the braking force in indirect towing mode.

2.6.2 Indirect towing principle

In indirect towing mode, the towline force is resulting from the (quasi-static) equilibrium condition reached between the forces and moments arising from the hydrodynamic lift and drag forces acting on the hull and appendices of the tug advancing through the water at a drift angle relative to the water flow, the thrust vector and the towline force.

Note 1: In direct towing mode the thrust is directly applied to generate the towline force, whereby hydrodynamic lift and drag forces play no significant role.

2.6.3 Various indirect towing modes

- a) In (basic) indirect mode the towline force is generated primarily by the hydrodynamic forces acting on the hull and skeg, with the thrust used solely to maintain the desired drift angle (also referred to as yaw angle)
- b) In powered indirect mode (indirect steering) the transverse component of thrust is used to maintain the desired drift angle, while a significant longitudinal component of thrust is applied in forward direction of the tug.

Compared to the (basic) indirect mode, the tug is operating more sideways of the escorted ship with a relatively large towline angle, generating a higher steering force

- c) In combination mode (indirect braking) the same principle as for the indirect steering mode is applied, except that the longitudinal component of thrust is applied in aftward rather than forward direction.

Compared to the (basic) indirect mode, the tug is operating more behind the escorted ship with a relatively small towline angle, generating a higher braking force.

2.6.4 Specific considerations

- For indirect towing modes it is recommended to design the tug to generate high (indirect) towline forces with minimal propulsion thrust, while respecting the limits imposed by stability and strength considerations (towing equipment, general hull structure).
- The propulsion engines are to ensure sufficient thrust for manoeuvring the tug quickly for any drift angle (refer to angle β as defined in [2.7.2]).
- In the case of loss of propulsion, the heeling moment due to the remaining forces is to lead to a safe equilibrium position of the tug with reduced heeling angle.

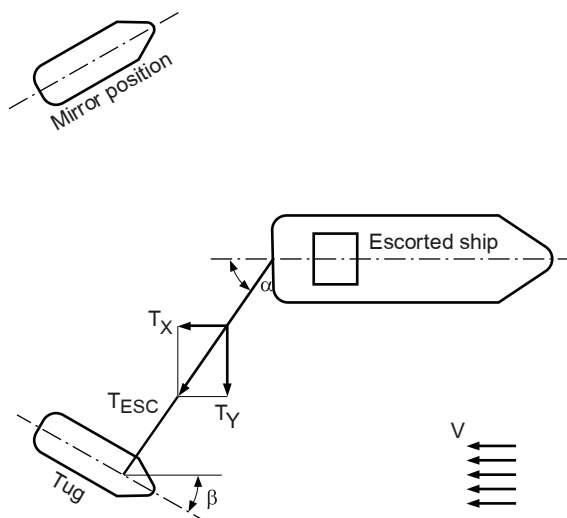
2.7 Escort forces and speed

2.7.1 The steady towline force during escorting, T_{ESC} , in kN, is the towline force associated with the considered (quasi-static) equilibrium in indirect towing mode, excluding short time-duration dynamic effects, for a given loading condition and escort speed V , see Fig 2. The steady towline force is applied by the tug on the stern of the escorted ship.

2.7.2 The following angles are defined in relation to escort operations (see Fig 2):

- The towline angle α , in deg, is the angle between the towline and the centreline of the escorted ship, and
- The drift angle β , in deg, is the angle between the centreline of the tug and the centreline of the escorted ship (also referred to as yaw angle).

Figure 2 : Typical escort configuration



2.7.3 The steady towline force T_{ESC} can be decomposed into a steering force T_Y and a braking force T_X (see Fig 2):

- The steering force T_Y , in kN, is the transverse component of the steady towline force T_{ESC} with respect to the escorted ship
- The braking force T_X , in kN, is the longitudinal component of the steady towline force T_{ESC} with respect to the escorted ship.

2.7.4 The design maximum escort speed V_{MAX} , in kn, is the highest escort speed V for which the escort tug is designed to perform escort operations, to be specified by the Designer and not to be taken higher than 10 knots.

Note 1: For high powered escort tugs with a free running speed of more than 15 knots the Society may, on a case-by-case basis, accept a design maximum escort speed of 12 knots.

2.7.5 The following rated values of the above defined escort forces are to be specified by the designer:

- The rated steady towline force $T_{ESC,R}$, in kN, is the highest anticipated steady towline force T_{ESC} , as obtained from the evaluation of the escort forces for a particular loading condition and escort speed, taking into account the applicable stability and strength criteria
- The rated steering force $T_{Y,R}$, in kN, is the highest anticipated steering force T_Y , as obtained from the evaluation of the escort forces for a particular loading condition and escort speed, taking into account the applicable stability and strength criteria
- The rated maximum braking force $T_{X,R}$, in kN, is the highest anticipated braking force T_X , as obtained from the evaluation of the escort forces for a particular loading condition and escort speed, taking into account the applicable stability and strength criteria.

2.7.6 The following maximum values of the above defined rated escort forces are to be specified by the designer:

- The design maximum steady towline force $T_{ESC,MAX}$, in kN, is the highest rated steady towline force $T_{ESC,R}$ over the applicable range of loading conditions and escort speeds
- The design maximum steering force $T_{Y,MAX}$, in kN, is the highest rated steering force $T_{Y,R}$ over the applicable range of loading conditions and escort speeds
- The design maximum braking force $T_{X,MAX}$, in kN, is the highest rated braking force $T_{X,R}$ over the applicable range of loading conditions and escort speeds.

2.7.7 The matrix of rated steady towline forces $T_{ESC,R}$, steering forces $T_{Y,R}$ and braking forces $T_{X,R}$ is to be initially specified by the Designer and to be verified by the Society on the basis of the results of:

- full scale trials, or
- model testing, or
- a computer simulation program accepted by the Society.

2.7.8 Full scale trials, where applicable, should be performed in accordance with a procedure agreed with the Society prior to commencement of the trials and comply with the requirements of Ch 1, Sec 5, [3.2].

2.7.9 Model testing, where applicable, should be performed in accordance with a procedure agreed with the Society prior to commencement of the tests and comply with the requirements of Ch 1, Sec 5, [3.2]. Special attention is to be paid to scale effects when processing the measurement result to create predictions at full scale.

2.7.10 Computer simulation programs for predicting escort performance are to comply with the requirements of Ch 1, Sec 5, [3.1].

2.8 Towing winch emergency release systems

2.8.1 Emergency release system refers to the mechanism and associated control arrangements that are used to release the load on the towline in a controlled manner under both normal and blackout conditions.

2.8.2 Maximum design load is the maximum load that can be held by the winch as defined by the manufacturer (the manufacturer’s rating).

2.8.3 Fleet angle is the angle between the applied load (towline force) and the towline as it is wound onto the winch drum (see Fig 3).

3 Fire safety

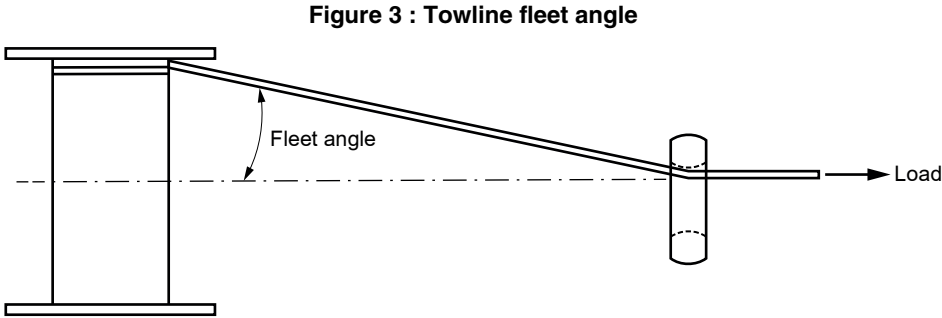
3.1 Suppression of fire

3.1.1 Fire pumps

For tugs assigned with the operating area notation **operating within 5 miles from shore**, the portable fire pump required in NR566, Ch 4, Sec 5, [2.2.3] may be omitted.

3.1.2 Fixed fire-extinguishing system

Tugs assigned with the operating area notation **operating within 5 miles from shore** may be considered as ships of less than 12 m operating in **coastal area** or **sheltered area** according to NR566, Ch 4, Sec 5, [4.2].



SECTION 2 STABILITY

1 Application

1.1

1.1.1 The requirements of this Section apply as follows depending on the ship service notation:

- **tug**, mainly intended for towing services, are to comply with the requirements in Article [2]
- **salvage tug**, having specific equipment for salvage services, are to comply with the requirements in Article [2]
- **escort tug**, mainly intended for escort services such as for steering, braking and otherwise controlling escorted ships, are to comply with the requirements in Articles [2] and [3].

In addition, ships with the additional service feature **barge combined** are to comply with the applicable requirements in Ch 1, Sec 4.

2 General requirements

2.1 Openings

2.1.1 Openings which cannot be closed weathertight
Openings in the hull, superstructures or deckhouses which cannot be closed weathertight are to be considered as unprotected openings and, consequently, as down-flooding points for the purpose of stability calculations (the lower edge of such openings is to be taken into account).

2.1.2 Ventilation openings of machinery space and emergency generator room

It is recognised that for tugs, due to their size and arrangement, compliance with the requirements of ICLL Reg. 17(3) for ventilators necessary to continuously supply the machinery space and the emergency generator room may not be practicable. Lesser heights of the coamings of these particular openings may be accepted if the openings:

- are positioned as close to the centreline and as high above the deck as practicable in order to maximise the down-flooding angle and to minimise exposure to green water
- are provided with weathertight closing appliances in combination with suitable arrangements, such as separators fitted with drains
- are equipped with efficient protective louvers and mist eliminators
- have a coaming height of not less than 900 mm above the deck
- are considered as unprotected openings and, consequently, as down-flooding points for the purpose of stability calculations.

2.2 Stability booklet

2.2.1 The stability booklet for ships engaged in harbour, coastal or ocean going towing operations and/or escort operations is to contain additional information on:

- maximum bollard pull
- details on the towing arrangement, including location and type of the towing point(s) such as towing hook, staple, fairlead or any other point serving that purpose
- recommendations on the use of roll reduction systems
- If any wire, etc. is included as part of the lightship weight, clear guidance on the quantity and size is to be given
- maximum and minimum draught for towing and escort operations
- instructions on the use of the quick-release device

2.3 Intact stability

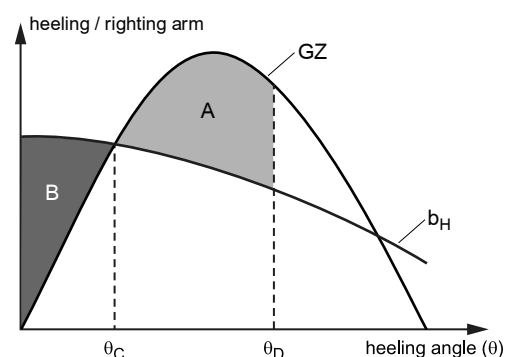
2.3.1 The stability of the ship for the loading conditions in Pt B, Ch 3, App 2, [1.2.11] is to be in compliance with the requirements in Pt B, Ch 3, Sec 2.

2.3.2 Additional intact stability criteria

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]).

Figure 1 : Heeling and righting arms curves



2.3.3 Self-tripping

A tug may be considered as having sufficient stability to withstand the self-tripping heeling moment if the following condition is complied with (see Fig 1):

$A \geq B$

where:

- A : Area, in m.rad, contained between the righting arm and the heeling arm curves, measured from the heeling angle θ_C to the heeling angle θ_D
- B : Area, in m.rad, contained between the heeling arm and the righting arm curves, measured from zero heel ($\theta = 0$) to the heeling angle θ_C
- θ_C : Heeling angle of equilibrium, corresponding to the first intersection between heeling and righting arms curves
- θ_D : Heeling angle, to be taken as the lesser of:
- heeling angle corresponding to the second intersection between heeling and righting arm curves
 - the angle of downflooding.

The self-tripping heeling arm curve is to be calculated as follows:

$b_H = \Sigma b_{Hi}$

where:

- b_{Hi} : Heeling arm induced by one thruster or group of thrusters i , in m, calculated as follows:

$$b_{Hi} = \frac{T_{BPI} C_i (h_i \cos \theta - r \sin \theta)}{9,81 \Delta}$$

- T_{BPI} : Amount of thrust, in kN, generated by one thruster or group of thrusters i . The sum of all the individual thrusts is to be equal to the design Bollard Pull, as defined in Ch 1, Sec 1, [2.1].

- h_i : Vertical distance, in m, between the towing point (fairlead, staple, towing hook or equivalent fitting) and the horizontal centreline of the propulsion unit or group of units i , as relevant for the considered towing situation

- r : Transverse offset, in m, between the towing point and the ship's centerline.

The towing point is the location where the tow-line force is applied to the ship (fairlead, staple, towing hook or equivalent fitting).

When the towing point is not at the center line, the most unfavourable tow line position is to be considered.

- C_i : Coefficient to be taken equal to:

- $c = 0,90 / (1 + d_i / L_{LL})$ for a group of 2 azimuthing thrusters, but is in no case to be taken less than:
 - 0,70 for ASD tugs towing over the stern and tractor tugs towing over the bow
 - 0,50 for ASD tugs towing over the bow and tractor tugs towing over the stern, respectively
- $c = 1 / (1 + d_i / L_{LL})$ for a single azimuthing thruster
- $c = 0,50$ for non-azimuth propulsion unit or group of units

- Δ : Loading condition displacement, in tons

- θ : Angle of heel, in degrees

- d_i : Longitudinal distance, in m, between the towing point (fairlead, staple, towing hook or equivalent fitting) and the vertical centreline of the propulsion unit or group of units i , as relevant for the considered towing situation

- L_{LL} : Load line length, in m, defined in Pt B, Ch 1, Sec 2, [3.2].

2.3.4 Tow-tripping

A tug may be considered as having sufficient stability to withstand the tow-tripping heeling moment if the first intersection between the righting arm curve and the tow-tripping heeling arm curve for tow-tripping occurs at an angle of heel less than the angle of downflooding.

The tow-tripping heeling arm curve is to be calculated as follows:

$$b_H = \frac{C_1 C_2 \gamma V^2 A_p (h \cos \theta - r \sin \theta + C_3 T)}{19,62 \Delta}$$

where:

- C_1 : Lateral traction coefficient, taken equal to:

$$C_1 = 2,8 \left(\frac{L_s}{L_{LL}} - 0,1 \right)$$

without being taken lower than 0,1 and greater than 1

- L_s : Longitudinal distance, in m, from the aft end of L_{LL} to the towing point

- C_2 : Angle of heel correction for C_1 , taken equal to:

$$C_2 = \left(\frac{\theta}{3\theta_d} + 0,5 \right)$$

without being taken lower than 1

- θ_d : Angle to deck edge, in deg, taken equal to:

$$\theta_d = \text{atan} \left(\frac{2f}{B} \right)$$

- f : Freeboard amidships, in m

- γ : Specific water density, in t/m³, to be taken equal to 1,025

- V : Lateral velocity, in m/s, to be taken equal to 2,57 (5 knots)

- A_p : Lateral projected area, in m², of the underwater hull

- C_3 : Distance from the center of A_p to the waterline as a fraction of the draught related to the heeling angle, taken equal to:

$$C_3 = \left(\frac{\theta}{\theta_d} \right) 0,26 + 0,3$$

without being taken lower than 0,5 and greater than 0,83

- T : Loading condition draught, in m

- h : Vertical distance, in m, from the waterline to the towing point.

3 Additional requirements for escort tugs

3.1 Intact stability

3.1.1 All the loading conditions reported in the trim and stability booklet which are intended for escorting operations are also to be checked in order to investigate the tug's capability to withstand the effect of the transverse heeling moment induced by the combined action of the following forces:

- hydrodynamic forces acting on the hull and appendices
- thrust forces
- steady towline force.

3.1.2 Allowance is to be made for the anticipated type of wire or rope on storage reels and wire on the winches when calculating loading conditions.

3.1.3 The stability calculations are to be performed on the basis of the highest anticipated heeling moment for the considered loading condition, which is to be obtained from the results of full scale tests, model tests, or, alternatively, the results of a computer simulation program accepted by the Society (refer to Ch 1, Sec 5, [3.1]).

3.1.4 For each relevant loading condition the evaluation of the highest anticipated heeling moment is to be performed for the applicable range of speeds and towline angles, as defined in the escort towing arrangement plan. As a minimum, the conditions corresponding to the design maximum steering force $T_{Y,MAX}$, and design maximum braking force $T_{X,MAX}$, as defined in Ch 1, Sec 1, [2.7], are to be included in the evaluation.

3.1.5 The highest anticipated heeling moment is to be assumed constant for the purpose of the stability calculations.

3.1.6 The value of the highest anticipated heeling moment is to be specified by the Designer in the stability calculations. In addition, an arrangement drawing with the location of the towing points and propulsion units is to be included in the stability booklet. In this drawing the longitudinal and vertical distance, in m, from the towing point to the relevant centrelines of the propulsion units and the baseline, respectively, are to be specified.

3.1.7 Preliminary stability calculations on the basis of estimated highest heeling moment and associated heeling arm values may be submitted for (preliminary) examination. If after verification of the heeling arm values on the basis of the results of escort performance trials, model tests or a computer simulation program accepted by the Society (refer to Ch 1, Sec 5, [3.1]) the final values exceed the estimated values, the stability calculations have to be updated for the final heeling moment and heeling arm values. It is recommended to include a reasonable margin in the estimated values (on the basis of design experience).

3.1.8 Criteria

An escort tug may be considered as having sufficient stability to withstand the heeling moment arising from the towline, if the three following conditions are complied with:

$$A \geq 1,25 B$$

$$C \geq 1,40 D$$

$$\theta_c \leq 15^\circ$$

where:

A : Righting arm curve area, in m-rad, measured from the heeling angle θ_c to a heeling angle of 20° (see Fig 2)

B : Heeling arm curve area, in m-rad, measured from the heeling angle θ_c to a heeling angle of 20° (see Fig 2)

C : Righting arm curve area, in m-rad, measured from zero heel ($\theta = 0$) to the heeling angle θ_D (see Fig 3)

D : Heeling arm curve area, in m-rad, measured from zero heel ($\theta = 0$) to the heeling angle θ_D (see Fig 3)

θ_c : Heeling angle of equilibrium, corresponding to the first intersection between heeling arm and righting arm curves, to be obtained when the highest anticipated heeling moment resulting from the steady towline force T_{ESC} as defined in Ch 1, Sec 1, Fig 2, is applied to the escort tug

θ_D : Heeling angle, to be taken as the lesser of:

- the angle of downflooding
- 40°
- the heeling angle corresponding to the second intersection between heeling and righting arm curves.

Figure 2 : Definition of the areas A and B

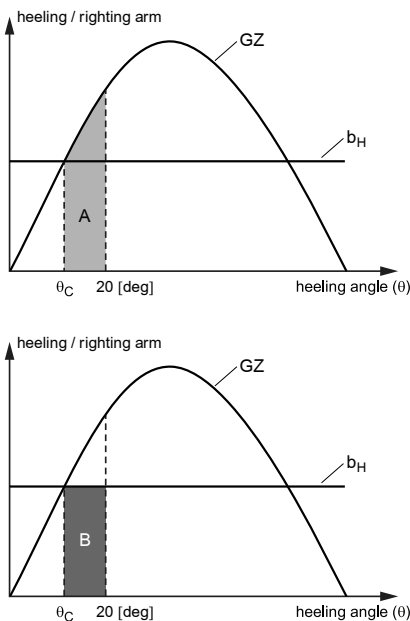
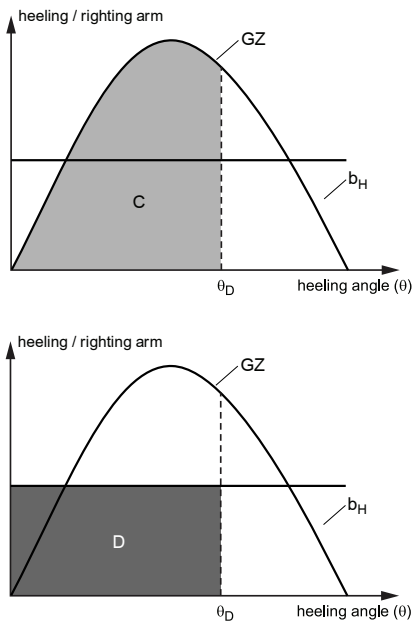


Figure 3 : Definition of the areas C and D



3.2 Stability booklet

3.2.1 Additional operating information is to be provided in the stability booklet in relation to the design limitations related to the assignment of the service notation escort tug. As a minimum, the following information is to be included:

- Design operating area and environmental conditions for performing escort operations (refer to Pt A, Ch 1, Sec 2, [4.7])

- The maximum escort speed V_{MAX} (refer to Ch 1, Sec 1, [2.7])
- A table with permissible values of heeling angle and steady towline force as function of loading condition and escort speed (based on the rated steering and braking forces as obtained from Ch 1, Sec 5, [3.1] or Ch 1, Sec 5, [3.2], as applicable)
- Instructions to the master regarding the handling of the escort tug and the associated towing equipment, demonstrating the implementation of effective means to limit the steady towline force and heeling angle within the permissible limits and the use of the emergency release system.

Note 1: Adjustable audible or visible alarms, providing a warning to the master when the heeling angle and/or steady towline force exceeds the permissible value(s) applicable to the relevant loading condition and escort speed, in combination with appropriate handling instructions are as effective means.

The table with permissible values of heeling angle and steady towline force as function of loading condition and escort speed is to be displayed in the wheelhouse next to the control desk or another appropriate location.

3.3 Inclinator

3.3.1 Escort tugs are to be equipped with a calibrated heeling angle measurement system (inclinator).

The measured heeling angle is to be displayed in the wheelhouse next to the control desk or another appropriate location.

SECTION 3

HULL STRUCTURE

1 General

1.1 Application

1.1.1 The requirements of this Section apply as follows depending on the ship service notation:

- **tug**, mainly intended for towing services, are to comply with the requirements in Article [2]
- **salvage tug**, having specific equipment for salvage services, are to comply with the requirements in Articles [2] and [4]
- **escort tug**, mainly intended for escort services such as for steering, braking and otherwise controlling escorted ships, are to comply with the requirements in Articles [2] and [3].

In addition, ships with the additional service feature **barge combined** are to comply with the applicable requirements in Ch 1, Sec 4.

1.2 Documents to be submitted

1.2.1 In addition to the documentation requested in Part B, the following documents are to be submitted for approval:

- Description of the connection between the towing system (winch and hook) and the hull structure with indication of the design loads.

2 General requirements

2.1 Typical design arrangements

2.1.1 General

In general, tugs are completely decked ships provided with an ample drift surface and, where intended for service outside sheltered areas, with a forecastle or half forecastle, or at least with a large sheer forward.

2.1.2 Conventional tugs

Conventional tugs have fixed single or multiple shaft arrangement. The propeller(s) can be of fixed pitch or controllable pitch type, normally fitted with Kort nozzle(s). Steering is done by means of rudder(s) or steerable nozzle(s). The towing point is normally located slightly aft of the centre of lateral resistance for towing over the stern with a towing hook and/or towing winch.

Conventional tugs may also be equipped to perform pushing operations.

2.1.3 Tractor tugs

Tractor tugs are fitted with omnidirectional thrusters (typically two steerable propellers or Voith-Schneider type cycloidal propulsion units), which are located forward of the towing point (usually not more than 30% of the length from the forward end). A skeg or vertical fin is fitted aft. Towing is performed over the stern with a towing winch and/or towing hook.

Tractor tugs may also be equipped to perform pushing operations.

2.1.4 Azimuth stern drive tugs (ASD tugs)

Azimuth stern drive (ASD) tugs are fitted with multiple steerable propellers located near the aft end. Typically, ASD tugs can perform towing operations over the bow with the forward towing winch (towing operation similar to a tractor tug) and over the stern with a towing hook and/or second towing winch (towing operation similar to a conventional tug). In both cases the towing point is located forward of the thrusters. ASD tugs may be fitted with a skeg, the size and location depending on the intended function.

ASD tugs may also be equipped to perform pushing operations.

2.1.5 Other design arrangements

Other tug design arrangements, having towing and propulsion configurations different from the design arrangements described in [2.1.1] to [2.1.4], have been developed and built, and are to be considered by the Society on a case-by-case basis.

For tugs with combined aft and fore thrusters, every thruster having the same longitudinal location is to be considered as belonging to the same group of thrusters.

2.2 Structure design principles

2.2.1 Bollards

For tugs equipped for side towing, the relevant bollards are to be effectively fixed on the deck in way of side transverses and deck beams or bulkheads.

2.2.2 Fenders

A strong fender for the protection of the tug's sides is to be fitted at deck level.

Alternatively, loose side fenders may be fitted, provided that they are supported by vertical ordinary stiffeners extending from the lightship waterline to the fenders themselves.

2.2.3 Floors

Floors are to be arranged with a welded face plate in the machinery space; elsewhere, floor flanging may be accepted as an alternative to the fitting of welded face plates.

2.2.4 Shaft tunnels

For tugs having small depth, the shaft tunnel may be omitted. In this case, access to the shaft line is to be given through the floor of the space above.

2.3 Hull scantlings

2.3.1 General

The net scantlings of plating, ordinary stiffeners and primary supporting members are to be in accordance with the applicable requirements defined in Ch 1, Sec 1, considering a scantling draught T not less than $0,85 D$ for the calculation of hull girder loads and local loads.

2.4 Other structures

2.4.1 Machinery casings

Exposed machinery casings are to be not less than 900 mm in height, measured from the upper surface of the deck, and provided with weathertight means of closure.

In general, the longitudinal sides of the machinery casings are to be extended downwards by a deck girder to which the deck beams are to be connected.

Side ordinary stiffeners are to be connected to the deck. Their spacing is to be not greater than 0,75 m.

2.4.2 Emergency exits from machinery space

Emergency exits from the machinery space to the upper deck are to be located as high as possible above the waterline and in way of the ship's centreline, so that they may be used even at extreme angles of heel.

Escape hatch coaming heights are to be not less than 600 mm above the upper surface of the deck.

Escape hatch covers are to have hinges fitted such that the predominant direction of green sea will cause the cover to close and are to be capable of being opened and closed weathertight from either side.

2.4.3 Height of hatchway coamings

The height of the hatchway coamings is to be not less than 300 mm. Hatch covers are to be fitted with efficient securing devices.

2.5 Rudder and bulwarks

2.5.1 Rudder

For tugs, the rudder stock diameter is to be increased by 5% with respect to that calculated according to the applicable requirement.

2.5.2 Bulwarks

The bulwarks are to be sloped inboard to avoid distortions likely to occur during contact. Their height may be reduced where required by operational necessities.

2.6 Anchoring and mooring equipment

2.6.1 Wire ropes

Wire ropes may be used as an alternative to chain cables as follows:

- a) Where $L \leq 40$ m, chain cables may be replaced by wire ropes of equal minimum breaking strength, which are to have:
 - a length 1,5 times the required chain cable length, and
 - a short length of chain cable between the wire rope and the anchor, having a length equal to 12,5 m or the distance from the anchor in the stowed position to the winch, whichever is the lesser.
- b) Where $40 \text{ m} < L \leq 90 \text{ m}$, both chain cables may be replaced by wire rope of equal minimum breaking strength which are to have:
 - a length 1,5 times the required chain cable length, and
 - a minimum mass per unit length of 30% of the required Grade 2 chain cable, and
 - a short length of chain cable between the wire rope and the anchor, having a length equal to 12,5 m or the distance from the anchor in the stowed position to the winch, whichever is the lesser.

2.6.2 Number of anchors

The number of anchors depends on the service notation and optional operating area notation, the propulsion arrangement and the application of a fixed fire-fighting installation. In general, the recommended number of anchors and chain cables is shown in Tab 1.

A reduction of the number of anchors and chain cables may be accepted as depicted in Tab 1 if the following conditions, based on redundancy principles, are complied with:

- the tug is equipped with at least twin propulsion, of which each main engine can maintain sufficient propulsion power to safely return to berth. For this purpose, the main engines should be able to run self-supporting, i.e. independent of generator sets intended for auxiliary power, unless these are able to run parallel and, in case of black-out, have automatic starting and connecting to switchboard within 45 seconds
- a single failure, except fire, is not to cause total propulsion failure
- a fixed fire fighting installation is provided.

It may be considered by the tug builder and operator to apply a spare anchor as an alternative to a second bower anchor. In such case special provisions, such as a crane and suitable storage space for the spare anchor, are to be present on board and the weight and dimensions of the anchor are to be such that it can be handled swiftly. For tugs with the operating area notation **operating ≤ 4 h from a place of refuge**, effectively operating in a fixed and limited area, the spare anchor may be stored ashore.

Table 1 : Number of anchors and chain cables

Service notation	Operating area notation	Number of anchor and chain cables	
		General	Reduced based on redundancy principles (1)
tug	operating within 5 miles from shore	1	0
tug	operating ≤ 4 h from a place of refuge	2	1
tug	–	2	2
salvage tug	–	2	2
escort tug	operating ≤ 4 h from a place of refuge	2	1
escort tug	–	2	2
(1) As detailed in [2.6.2].			

Table 2 : Design loads for equipments used for towing operations and supporting structures

Service notation	Operating area notation	T _{BP} , in kN	DL, in kN
tug	operating within 5 miles from shore	T _{BP} ≤ 200	2 T _{BP}
		200 < T _{BP} < 800	[(2600 - T _{BP}) / 1200] T _{BP}
		T _{BP} ≥ 800	1,5 T _{BP}
tug / salvage tug / escort tug	—	T _{BP} ≤ 400	2,5 T _{BP}
		400 < T _{BP} < 1000	[(3400 - T _{BP}) / 1200] T _{BP}
		T _{BP} ≥ 1000	2 T _{BP}
Note 1: The DL takes into consideration dynamic effects through the application of the dynamic amplification factor (DAF) (see also Ch 1, Sec 1, [2.3]).			

2.7 Towing equipment

2.7.1 General

Towing winches, towing hooks and towline guiding fittings (fairleads, staples, gob-eyes, towing pins, etc.) are normally to be arranged in way of the tug's centerline, in such a position as to minimise heeling moment exerted by the towline force. Effective means are to be provided to lead and restrain the towline within the designed limits of its sweep.

Materials used in towing equipment are to comply with the applicable class requirements for materials. Class certificates are required for the materials used for winch drums, drum shafts, winch brake components, winch supporting frames, towing hooks and towline guiding fittings.

2.7.2 Design load

The design load DL to be considered for the strength assessment of the towing equipment and the associated supporting structures is given in Tab 2.

2.7.3 Towing winches

- a) The winch brake shall normally act directly on the drum and shall be operable in case of failure of the primary power supply system (either manually or otherwise arranged).

- b) The in-board end of the towline is to be attached to the winch drum with a weak link or similar arrangement that is designed to release the towline at low load.
- c) Towing winches are to be provided with an emergency release system as described in [2.7.4].
- d) Means are to be provided to prevent the fleet angle as shown on Ch 1, Sec 1, Fig 3 from becoming great enough to inhibit operation of the emergency release system.
- e) The dimensioning of the winch drum is to take into account the rope bending specifications provided by the towline manufacturer.
- f) Due consideration is to be given to the proper spooling of the towline on the winch drum, as well as preventing the towline to slip over the flanges of the drum.
- g) Towing winches (in particular the components which are exposed to the tension in the towline, such as the winch drums, drum shafts, brakes, support frame and connection to the hull structure) shall be able to:
- sustain the DL, as specified in [2.7.2] without permanent deformation, and
 - sustain the BHL, as defined Ch 1, Sec 1, [2.4], without exceeding an equivalent stress level (based on Von Mises criterion) of 0,80 R_{eH}.
 - sustain the loads for the rated pull condition, as foreseen by the Designer, without exceeding an equivalent stress level (based on Von Mises criterion) of 0,40 R_{eH}.

where:

R_{eH} : Minimum specified yield stress of material, in N/mm²

rated pull: Winch maximum hauling in load at the first inner layer.

- h) Where deemed necessary by the Society, buckling and/or fatigue analysis, performed in accordance with a standard or code of practice recognised by the Society, may be required to be submitted for information.
- i) Towing winches may be equipped with an active pay-out and haul-in system for automatic adjustment of towline. In that case the relevant requirements of [3.2.3] and Ch 1, Sec 5, [3.3] are to be complied with.
- j) It is recommended that the towing winch is fitted with equipment to continuously measure the tension in the towline.

In case a towline measurement system is installed on board, the measured data are to be displayed in the wheelhouse next to the control desk or another appropriate location.

2.7.4 Emergency release system

a) Performance:

- 1) The emergency release system is to operate across the full range of towline load, fleet angle and ship heel angle under all normal and reasonably foreseeable abnormal conditions (these may include, but are not limited to, the following: vessel electrical failure, variable towline load (for example due to heavy weather), etc.).
- 2) The emergency release system is to be capable of operating with towline loads up to at least 100 per cent of the maximum design load.
- 3) The emergency release system is to function as quickly as is reasonably practicable and within a maximum of three seconds after activation.
- 4) The emergency release system is to allow the winch drum to rotate and the towline to pay out in a controlled manner such that, when the emergency release system is activated, there is sufficient resistance to rotation to avoid uncontrolled unwinding of the towline from the drum. Spinning (free, uncontrolled rotation) of the winch drum is to be avoided, as this could cause the towline to get stuck and disable the release function of the winch.
- 5) Once the emergency release is activated, the towline load required to rotate the winch drum is to be no greater than:
 - the lesser of five tonnes or five per cent of the maximum design load when two layers of towline are on the drum, or
 - 15 per cent of the maximum design load where it is demonstrated that this resistance to rotation does not exceed 25 per cent of the force that will result in listing sufficient for the immersion of the lowest unprotected opening.
- 6) Emergency release of the towline is to be possible in the event of a blackout. For this purpose, where additional sources of energy are required, such sources are to comply with item 7) below.

- 7) The sources of energy required by item 6) are to be sufficient to achieve the most onerous of the following conditions (as applicable):

- sufficient for at least three attempts to release the towline (i.e. three activations of the emergency release system). Where the system provides energy for more than one winch it is to be sufficient for three activations of the most demanding winch connected to it.
- Where the winch design is such that the drum release mechanism requires continuous application of power (e.g. where the brake is applied by spring tension and released using hydraulic or pneumatic power) sufficient power is to be provided to operate the emergency release system (e.g. hold the brake open and allow release of the towline) in the event of a blackout for a minimum of five minutes. This may be reduced to the time required for the full length of the towline to feed off the winch drum at the load specified in item 5) if this is less than five minutes.

b) Monitoring and control:

- 1) Emergency release operation is to be possible from the bridge and from the winch control station on deck. The winch control station on deck is to be in a safe location.

A position in close proximity to the winch is not regarded as "safe location", unless it is documented that the position is at least protected against towline break or winch failure.
- 2) The emergency release control is to be located close to an emergency stop button for winch operation, if provided, and both are to be clearly identifiable, clearly visible, easily accessible and positioned to allow safe operability.
- 3) The emergency release function is to take priority over any emergency stop function. Activation of the winch emergency stop from any location is not to inhibit operation of the emergency release system from any location.
- 4) Emergency release system control buttons are to require positive action to cancel, the positive action may be made at a different control position from the one where the emergency release was activated. It is always to be possible to cancel the emergency release from the bridge regardless of the activation location and without manual intervention on the working deck.
- 5) Controls for emergency use are to be protected against accidental use.
- 6) Indications are to be provided on the bridge for all power supply and/or pressure levels related to the normal operation of the emergency release system. Alarms are to activate automatically if any level falls outside of the limits within which the emergency release system is fully operational.

The following emergency release system alarms and indications are to be provided on the bridge:

- Low fluid pressure in the control system
 - Low accumulator/ air pressure
 - Low battery voltage (separate alarm and indication not required where electrical power is supplied from the tug's emergency batteries).
- 7) Wherever practicable, control of the emergency release system is to be provided by a hard-wired system, fully independent of programmable electronic systems.
 - 8) Computer based systems that operate or may affect the control of emergency release systems are to meet the requirements for Category III systems (see Pt C, Ch 3, Sec 3, [2.3]).
 - 9) Components critical for the safe operation of the emergency release system are to be identified by the manufacturer.
- c) General test requirements
- 1) For each emergency release system or type thereof, the performance requirements of paragraph a) are to be verified either at the manufacturer's works or as part of the commissioning of the towing winch when it is installed on board. In any case, this test is to be witnessed by a Surveyor. Where verification solely through testing is impracticable (e.g. due to health and safety), testing may be combined with inspection, analysis or demonstration in agreement with the Society.
 - 2) The performance capabilities, as well as instructions for operation, of the emergency release system are to be documented by the manufacturer and made available on board the ship on which the winch has been installed.
 - 3) Instructions for surveys of the emergency release system are to be documented by the manufacturer, agreed by the Society and made available on board the ship on which the winch has been installed.
 - 4) Where necessary for conducting the annual and special surveys of the winch, adequately sized strong points are to be provided on deck.
- d) Installation trials
- 1) The full functionality of the emergency release system is to be tested as part of the shipboard commissioning trials to the satisfaction of the surveyor. Testing may be conducted either during a bollard pull test or by applying the towline load against a strong point on the deck of the tug that is certified to the appropriate load.
 - 2) Where the performance of the winch in accordance with paragraph a) has previously been verified, the load applied for the installation trials is to be at least the lesser of 30% of the maximum design load or 80% of vessel bollard pull.

2.7.5 Towing hooks

- a) Towing hooks and their load carrying attachments (connecting the towing hook to the hull structure) shall be able to sustain the DL, as specified in [2.7.2], without

exceeding an equivalent stress level (based on Von Mises criterion) of $0,80 R_{eH}$.

- b) Towing hooks shall be provided with an emergency release system operable from a position on the bridge with full view and control of the towing operation, as well as at a location near the hook where the device can be safely operated. Identical means of control for the emergency release systems shall be provided at each control station and are to be protected against unintentional use.

The force necessary to open the hook under load is to be not greater than 150 N.

The applicable procedures for the emergency quick-release device shall be communicated to the crew and vital information shall be displayed next to the control desk or another appropriate location.

2.7.6 Towlines

- a) The breaking strength of towlines is not to be less than the DL, as specified in [2.7.2].
In addition, the breaking strength of towlines used on a towing winch is not to be less than the BHL of the associated winch (see Ch 1, Sec 1, [2.4]).
- b) The towline shall be protected from being damaged by chafing and abrasion. To this end cargo rails, bulwarks, and other elements supporting the towline should be sufficiently rounded with consideration to the bend radius limit of the towline in order to ensure that the towline breaking strength is maintained.
- c) It is recommended that the total length of the towline applied on a towing winch is such that under normal operation, at least half a layer remains on the drum. In no case less than three turns shall remain on the drum in under normal operation.

2.7.7 Towline guiding fittings

- a) Towline guiding fittings, such as fairleads, staples, gobs, eyes, towing pins, stern rollers and equivalent components which guide the towline, shall be able to sustain the force exerted by the towline loaded under a tension equal to the DL, as specified in [2.7.2], in the most unfavourable anticipated position of the towline without exceeding the following stress level criteria:

- Normal stress: $\sigma \leq 0,75 R_{ref}$
- Shear stress: $\tau \leq 0,47 R_{ref}$
- Equivalent stress: $\sigma_{VM} \leq 0,85 R_{ref}$

where:

R_{ref} : Reference stress of the material, in N/mm², normally to be taken as 235/k, but may be taken as R_{eH} for fittings not made of welded construction.

- b) Towline guiding fittings used for guiding the towline when towing on a towing winch shall be able to sustain the force exerted by the towline loaded under a tension equal to the BHL of the associated winch, as specified in Ch 1, Sec 1, [2.4], in the most unfavourable anticipated position of the towline without exceeding the stress level criteria mentioned in a).

- c) Where a towline guiding fitting (e.g. fairlead or guide pin) has been designed for a specific Safe Working Load SWL, defined as the maximum static working load, the fitting shall be able to sustain a force equal to 2 times the SWL without exceeding the stress level criteria mentioned in a).
- d) In case the yielding check of the towline guiding fittings is carried out by means of a three dimensional finite element model, the permissible stress levels given above may be increased by 10 per cent (compared to a beam model).

2.7.8 Supporting structures

- a) The supporting structures of towing equipment shall be able to sustain the load exerted on the supporting structure under the action of the towline loaded under a tension equal to the DL, as specified in [2.7.2], in the most unfavourable anticipated position of the towline, without exceeding the stress level criteria specified in [2.7.7].
- b) Supporting structures of towing equipment engaged when towing on a towing winch shall be able to sustain the load exerted on the supporting structure under the action of the towline loaded under a tension equal to the BHL of the associated winch, as specified in Ch 1, Sec 1, [2.4], in the most unfavourable anticipated position of the towline without exceeding the stress level criteria specified in [2.7.7].
- c) Where a towline guiding fitting has been designed for a specific Safe Working Load SWL, defined as the maximum static working load, the associated supporting structure shall be able to sustain a force equal to 2 times the SWL without exceeding the stress level criteria specified in [2.7.7].
- d) In case the yielding check of the towing equipment supporting structures is carried out by means of a three dimensional finite element model, the permissible stress levels given above may be increased by 10 per cent (compared to a beam model).

2.7.9 Fendering

- a) A robust and efficient fendering system is to be fitted in areas intended for pushing. The fendering system purpose is to distribute the pushing force and limit its dynamic component on the hull structure of both the tug and the assisted ship.
- b) For the purpose of this requirement, it is considered that during pushing operations, the contact between the tug and the assisted ship is maintained and that no bouncing (e.g. under wave action) is taking place. Forces resulting from bouncing loads are not taken into consid-

eration, as it is understood that pushing operations (in waves) are normally halted when bouncing starts taking place (due to operational difficulties to keep position within the pushing area of the assisted ship as well as to control the associated impact type loads).

- c) The design load DL to be considered for the strength assessment of the fender supporting structure may be taken as follows:

$$DL = 1,5 T_{BP}$$

where:

T_{BP} : Design bollard pull, as defined in Ch 1, Sec 1, [2.1].

The DL takes into consideration anticipated dynamic effects through the application of the dynamic amplification factor (see also Ch 1, Sec 1, [2.3]), but not bouncing effects (see above).

The fender supporting structure shall be able to sustain the DL, as specified above, without exceeding the stress level criteria specified in [2.7.7].

3 Additional requirements for escort tugs

3.1 Structural design principles

3.1.1 Hull shape

The hull shape is to be such as to provide adequate hydrodynamic lift and drag forces and to avoid excessive trim angles for large heeling angles.

3.1.2 Bulwark

A bulwark is to be fitted all around the weather deck.

3.2 Equipment for escort operations

3.2.1 General

Towing winches and towline guiding fittings (fairleads, staples, etc.) used for escort services are normally to be arranged in way of the tug's centreline, in such a position as to minimise heeling moment.

Materials used in towing equipment are to comply with the applicable class requirements for materials. Class certificates are required for the materials used for winch drums, drum shafts, winch brake components, winch supporting frames and towline guiding fittings.

3.2.2 Design load

The design load DL to be considered for the strength assessment of the towing equipment used for escort services and the associated supporting structures is given in Tab 3.

Table 3 : Design Loads for equipment used for escort operations and supporting structures

$T_{ESC,MAX}$, in kN	DL, in kN	
	General case	Escort tugs assigned with the operating area notation escort service limited to non-exposed waters
≤ 500	$3 T_{ESC,MAX}$	$2,4 T_{ESC,MAX}$
$500 < T_{ESC,MAX} \leq 1000$	$[(2000 - T_{ESC,MAX}) / 500] T_{ESC,MAX}$	$[(2000 - T_{ESC,MAX}) / 625] T_{ESC,MAX}$
> 1000	$2 T_{ESC,MAX}$	$1,6 T_{ESC,MAX}$
Note 1: The DL takes into consideration dynamic effects through the application of the Dynamic Amplification Factor (DAF) (see also Ch 1, Sec 1, [2.3]).		

3.2.3 Escort winches

- a) The winch brake shall normally act directly on the drum and shall be operable in case of failure of the primary power supply system (either manually or otherwise arranged).
- b) Escort winches intended to be used in conditions where dynamic oscillations of the towline are likely to occur, such as in open sea areas or other areas exposed to waves, are to be equipped with an active pay-out and haul-in system.
This system is to automatically and reliably pay-out the towline in a controlled manner when the towline force exceeds a pre-set (adjustable) level equal to 110 per cent of the rated towline force $T_{ESC,R}$ and, as the towline force is reduced, actively haul-in the towline to prevent slack-line events and maintain a pre-set or adjustable towline force consistent with the rated towline force.
Pay-out and haul-in speeds and pull capability shall be chosen taking into account the anticipated escort services and the dynamic characteristics of the escort tug.
- c) Escort operations in conditions where dynamic oscillations of the towline are likely to occur may not be based on the use of the brakes of the winch drum.
- d) Escort operations performed by escort tugs with the operating area notation **escort service limited to non-exposed waters** and any escort operation in calm water conditions, such as in ports and sheltered (confined) waters, may be based on the use of the brakes of the winch drum. As a minimum, the winch brake holding load BHL is to be equal to or greater than two times the maximum steady towline force $T_{ESC,MAX}$.
- e) Escort winches are to be fitted with equipment to continuously measure the tension in the towline.
The measured data are to be displayed in the wheel-house next to the control desk or another appropriate location.
- f) The escort towing system is to be designed so as to enable the proper spooling of the towline on the winch drum when hauling in. Generally this can be achieved by a suitable design of the fairlead or staple guiding the towline between the escort winch and the assisted ship. Where a spooling device is fitted, this device should be designed for the same Design Load and stress criteria as the towline guiding fittings, see [3.2.5].
- g) Winches are to be provided with an emergency release system as defined in [2.7.4].

- h) The dimensioning of the winch drum is to take into account the rope bending specifications provided by the towline manufacturer.
Due consideration is to be given to preventing the towline to slip over the flanges of the drum.
- i) Escort winches (in particular the components which are exposed to the tension in the towline, such as the winch drums, drum shafts, brakes, support frame and connection to the hull structure) shall be able to:
- sustain the DL, as specified in [3.2.2] without permanent deformation, and
 - sustain the BHL, as defined in Ch 1, Sec 1, [2.4], without exceeding an equivalent stress level (based on Von Mises criterion) of $0,80 R_{eH}$
 - sustain the loads for the rated pull condition, as foreseen by the Designer, without exceeding an equivalent stress level (based on Von Mises criterion) of $0,40 R_{eH}$.
- where:
- R_{eH} : Minimum specified yield stress of material, in N/mm²
- rated pull: Winch maximum hauling in load at the first inner layer.
- j) Where deemed necessary by the Society, buckling and/or fatigue analysis, performed in accordance with a standard or code of practice recognized by the Society, may be required to be submitted for information.

3.2.4 Towlines

- a) The breaking strength of towlines used for escort services is not to be less than the DL, as specified in [3.2.2].
In addition, the breaking strength for towlines used for escort services on an escort winch is not to be less than the BHL of the associated escort winch (see Ch 1, Sec 1, [2.4]).
- b) The towline shall be protected from being damaged by chafing and abrasion. To this end cargo rails, bulwarks, and other elements supporting the towline should be adequately rounded.
- c) It is recommended that the total length of the towline applied on a towing winch is such that under normal operation, at least half a layer remains on the drum. In no case less than three turns shall remain on the drum in under normal operation.

3.2.5 Towline guiding fittings

- a) Towline guiding fittings used for escort services, such as fairleads, staples and equivalent components which guide the towline, shall be able to sustain the force exerted by the towline loaded under a tension equal to the DL, as specified in [3.2.2], in the most unfavourable anticipated position of the towline without exceeding the stress level criteria specified in [2.7.7].
- b) In addition, towline guiding fittings shall be able to sustain the force exerted by the towline loaded under a tension equal to the BHL of the associated winch, as specified in Ch 1, Sec 1, [2.4], in the most unfavourable anticipated position of the towline without exceeding the stress level criteria specified in [2.7.7].
- c) Where a towline guiding fitting has been designed for a specific safe working load SWL, defined as the maximum static working load, the fitting shall be able to sustain a force equal to 2 times the SWL without exceeding the stress level criteria specified in [2.7.7].
- d) In case the yielding check of the towline guiding fittings is carried out by means of a three dimensional finite element model, the permissible stress levels given above may be increased by 10 per cent (compared to a beam model).

3.2.6 Supporting structures

- a) The supporting structures of towing equipment used for escort services shall be able to sustain the load exerted on the supporting structure under the action of the towline loaded under a tension equal to the DL, as specified

in [3.2.2], in the most unfavourable anticipated position of the towline, without exceeding the stress level criteria specified in [2.7.7].

- b) In addition, supporting structures of towing equipment used for escort services shall be able to sustain the load exerted on the supporting structure under the action of the towline loaded under a tension equal to the BHL of the associated winch, as specified in Ch 1, Sec 1, [2.4], in the most unfavourable anticipated position of the towline without exceeding the stress level criteria specified in [2.7.7].
- c) Where a towline guiding fitting has been designed for a specific safe working load SWL, defined as the maximum static working load, the associated supporting structure shall be able to sustain a force equal to 2 times the SWL without exceeding the stress level criteria specified in [2.7.7].
- d) In case the yielding check of the towing equipment supporting structures is carried out by means of a three dimensional finite element model, the permissible stress levels given above may be increased by 10 per cent (compared to a beam model).

4 Additional requirements for salvage tugs

4.1 Equipment

4.1.1 Ships with the navigation notation salvage tug are to be fitted with the additional equipment specified in Tab 4.

Table 4 : Additional equipment for salvage tugs

Arrangement or equipment	Number of items
Fixed or movable drainage pumps having approximately the same capacity (1) (2) (3)	2 or more pumps of total capacity ≥ 400 m³/h
Fire pumps each capable of throwing two simultaneous jets of water having a horizontal reach not less than 30 m (4)	2 pumps, each having a capacity ≥ 60 m³/h
Breathing apparatuses for divers	2
Gas masks with filter	2
Cargo boom	1, with service load ≥ 1 t
Power operated winch capable of producing an adequate pull	1
Water stops to stop leaks of approximately 1 x 2 m	4
Complete set of equipment for flame cutting with at least 25 metres of flexible piping	1
Drain hoses	at least 20 m per pump
Fire hoses	10
Connections for fire main	at least 3
(1) For each pump fitted on board, a suction strainer and, in the case of non self-priming pumps, a foot valve, are also to be provided.	
(2) Where portable pumps are used, they are to be capable of effectively operating even with transverse and longitudinal inclinations up to 20°.	
(3) These pumps are additional to the drain pumps intended for the drainage service of the ship.	
(4) These pumps may be the same required for drainage purposes provided they have an adequate head.	
(5) As an alternative, a compressor for recharging the oxygen tanks of divers may be provided together with two complete sets of equipment for divers.	
(6) Winding drums fitted on board are to be capable of housing wire ropes of suitable size and length not normally less than 350 m.	