

# Rules for the Classification of Naval Ships

NR 483 - June 2017



## Part D - Service Notations







# Rules for the Classification of Naval Ships

## PART D – Service Notations

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**BUREAU  
VERITAS**

# MARINE & OFFSHORE - GENERAL CONDITIONS

## 1. INDEPENDENCY 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, manufacturer, shipbuilder, repair or conversion yard, charterer or shipowner; none of them above listed being relieved of any of their expressed or implied obligations as a result of the interventions of the Society.
- 1.4. The Services are carried out by the Society according to the applicable Rules and to the Bureau Veritas Code of Ethics. The Society only is qualified to apply and interpret its Rules.
- 1.5. The Client acknowledges the latest versions of the Conditions and of the applicable Rules applying to the Services' performance.
- 1.6. Unless an express written agreement is made between the Parties on the applicable Rules, the applicable Rules shall be the rules applicable at the time of the Services' performance and contract's execution.
- 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 class certificates, attestations and reports following the Society's intervention. The Certificates are an appraisal given by the Society to the Client, at a certain date, following surveys by its surveyors on the level of compliance of the Unit to the Society's Rules or to the documents of reference for the Services provided. They cannot be construed as an implied or express warranty of safety, fitness for the purpose, seaworthiness of the Unit or of its value for sale, insurance or chartering.
- 2.2. "Certification" means the activity of certification in application of national and international regulations or standards, in particular by delegation from different governments that can result in the issuance of a certificate.
- 2.3. "Classification" means the classification of a Unit that can result or not in the issuance of a class certificate with reference to the Rules.
- 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 register published annually by the Society.
- 2.11. "Rules" means the Society's classification rules, guidance notes and other documents. The Rules, procedures and instructions of the Society 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, training activities, all activities and duties incidental thereto such as documentation on any supporting means, software, instrumentation, measurements, tests and trials on board.
- 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 the 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. 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.

3.2. Subject to the Services performance and always by reference to the Rules, the Society shall:

- review the construction arrangements of the Unit as shown on the documents provided by the Client;
- conduct the Unit surveys at the place of the Unit construction;
- class the Unit and enters the Unit's class in the Society's Register;
- survey the Unit periodically in service to note that 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.

The Society will not:

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

## 4. RESERVATION CLAUSE

- 4.1. The Client shall always: (i) maintain the Unit in good condition after surveys; (ii) present the Unit after surveys; (iii) present the Unit for surveys; and (iv) inform the Society in due course of any circumstances that may affect the given appraisal of the Unit or cause to modify the scope of the Services.
- 4.2. Certificates referring to the Society's Rules 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.

## 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, drawings, etc. required for the performance of the Services must be made available in due time.
- 5.2. The Client shall notify the Society of any relevant safety issue and shall take all necessary safety-related measures to ensure a safe work environment for the Society or any of its officers, employees, servants, agents or subcontractors and shall comply with all applicable safety regulations.

## 6. PAYMENT OF INVOICES

- 6.1. The provision of the Services by the Society, whether complete or not, involve, for the part carried out, the payment of fees thirty (30) days upon issuance of the invoice.
- 6.2. Without prejudice to any other rights hereunder, in case of Client's payment default, the Society shall be entitled to charge, in addition to the amount not properly paid, interests equal to twelve (12) months LIBOR plus two (2) per cent as of due date calculated on the number of days such payment is delinquent. The Society shall also have the right to withhold certificates and other documents and/or to suspend or revoke the validity of certificates.
- 6.3. In case of dispute on the invoice amount, the undisputed portion of the invoice shall be paid and an explanation on the dispute shall accompany payment so that action can be taken to solve the dispute.

## 7. LIABILITY

- 7.1. The Society bears no liability for consequential loss. For the purpose of this clause consequential loss shall include, without limitation:
  - Indirect or consequential loss;
  - Any loss and/or deferral of production, loss of product, loss of use, loss of bargain, loss of revenue, loss of profit or anticipated profit, loss of business and business interruption, in each case whether direct or indirect.

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

- 7.2. In any case, the Society's maximum liability towards the Client is limited to one hundred and fifty per-cents (150%) of the price paid by the Client to the Society for the performance of the Services. This limit applies regardless of fault by the Society, including 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 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 agrees to release, 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 except for those claims caused solely and completely by the negligence of the Society, its officers, employees, servants, agents or subcontractors.

## 9. TERMINATION

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

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

## 10. FORCE MAJEURE

- 10.1. Neither Party shall be responsible for any failure to fulfil any term or provision of the Conditions if and to the extent that fulfilment has been delayed or temporarily prevented by a force majeure occurrence without the fault or negligence of the Party affected and which, by the exercise of reasonable diligence, the said Party is unable to provide against.
- 10.2. For the purpose of this clause, force majeure shall mean any circumstance not being within a Party's reasonable control including, but not limited to: acts of God, natural disasters, epidemics or pandemics, wars, terrorist attacks, riots, sabotages, impositions of sanctions, embargoes, nuclear, chemical or biological contaminations, laws or action taken by a government or public authority, quotas or prohibition, expropriations, destructions of the worksite, explosions, fires, accidents, any labour or trade disputes, strikes or lockouts

## 11. CONFIDENTIALITY

- 11.1. The documents and data provided to or prepared by the Society in performing the Services, and the information made available to the Society, are treated as confidential except where the information:
  - is already known by the receiving Party from another source and is properly and lawfully in the possession of the receiving Party prior to the date that it is disclosed;
  - is already in possession of the public or has entered the public domain, otherwise than through a breach of this obligation;
  - is acquired 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 Society and the Client 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. 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 for the performance of the Services including, but not limited to drawings, calculations, and reports shall remain exclusive property of the Society.

## 13. ASSIGNMENT

- 13.1. The contract resulting from these Conditions cannot be assigned or transferred by any means by a Party to a 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

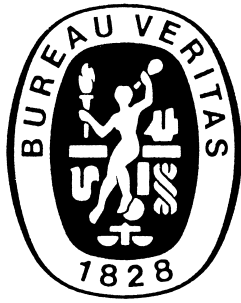
- 14.1. Invalidity of one or more provisions does not affect the remaining provisions.
- 14.2. Definitions herein take precedence over other definitions which may appear in other documents issued by the Society.
- 14.3. In case of doubt as to the interpretation of the Conditions, the English text shall prevail.

## 15. GOVERNING LAW AND DISPUTE RESOLUTION

- 15.1. The Conditions shall be construed and governed by the laws of England and Wales.
- 15.2. The Society and the Client shall make every effort to settle any dispute amicably and in good faith by way of negotiation within thirty (30) days from the date of receipt by either one of the Parties of a written notice of such a dispute.
- 15.3. Failing that, the dispute shall finally be settled by arbitration under the LCIA rules, 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 London (UK).

## 16. PROFESSIONAL ETHICS

- 16.1. Each Party shall conduct all activities in compliance with all laws, statutes, rules, 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. 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 Society's Code of Ethics of Bureau Veritas, <http://www.bureauveritas.com/home/about-us/ethics-and-compliance>



# RULES FOR THE CLASSIFICATION OF NAVAL SHIPS

## Part D Service Notations

### Chapters 1 2 3 4 5 6

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|           |                                 |
|-----------|---------------------------------|
| Chapter 1 | FRIGATE                         |
| Chapter 2 | AIRCRAFT CARRIER                |
| Chapter 3 | CORVETTE                        |
| Chapter 4 | AUXILIARY NAVAL VESSEL          |
| Chapter 5 | AMPHIBIOUS VESSEL               |
| Chapter 6 | MILITARY OFFSHORE PATROL VESSEL |

**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 June 1st, 2017. The Society may refer to the contents hereof before June 1st, 2017, as and when deemed necessary or appropriate.**

# CHAPTER 1

## FRIGATE

### Section 1 General

|     |               |    |
|-----|---------------|----|
| 1   | General       | 23 |
| 1.1 | Application   |    |
| 1.2 | Summary table |    |

### Section 2 Machinery and Systems

|     |                 |    |
|-----|-----------------|----|
| 1   | General         | 24 |
| 1.1 | Application     |    |
| 2   | Main propulsion | 24 |
| 2.1 | Availability    |    |

### Section 3 Electrical Installations

|     |                                   |    |
|-----|-----------------------------------|----|
| 1   | General                           | 25 |
| 1.1 | Applicability                     |    |
| 1.2 | Environmental conditions          |    |
| 2   | Design of electrical installation | 25 |
| 2.1 | Essential services                |    |
| 2.2 | Specific power supply             |    |

### Section 4 Fire Protection

|     |                           |    |
|-----|---------------------------|----|
| 1   | General                   | 26 |
| 1.1 | Application               |    |
| 1.2 | Documents to be submitted |    |
| 2   | General requirements      | 26 |
| 2.1 | Ship subdivisions         |    |

# CHAPTER 2

## AIRCRAFT CARRIER

### Section 1 General

|     |                                                       |    |
|-----|-------------------------------------------------------|----|
| 1   | General                                               | 31 |
| 1.1 | Application                                           |    |
| 1.2 | Summary table                                         |    |
| 2   | Definition                                            | 31 |
| 2.1 | General                                               |    |
| 2.2 | Aircraft operation                                    |    |
| 3   | Subdivision arrangement                               | 31 |
| 3.1 | After peak, machinery space bulkheads and stern tubes |    |
| 3.2 | Doors                                                 |    |
| 4   | Compartment arrangement                               | 31 |
| 4.1 | Fuel oil tanks                                        |    |

### Section 2 Hull and Stability

|     |                                                                 |    |
|-----|-----------------------------------------------------------------|----|
| 1   | Stability                                                       | 32 |
| 1.1 | Intact stability                                                |    |
| 1.2 | Damage stability                                                |    |
| 2   | Structure design principles                                     | 32 |
| 2.1 | General information                                             |    |
| 2.2 | Flight deck                                                     |    |
| 2.3 | Hangar                                                          |    |
| 2.4 | Sponsons                                                        |    |
| 2.5 | Fixed cranes on deck                                            |    |
| 2.6 | Aircraft elevators                                              |    |
| 2.7 | Ammunitions elevators                                           |    |
| 3   | Design loads                                                    | 34 |
| 3.1 | Local loads on flight deck                                      |    |
| 3.2 | Local loads on hangar deck and mezzanines                       |    |
| 3.3 | Local loads on island and bridge                                |    |
| 3.4 | Local loads on sponsons                                         |    |
| 3.5 | Loads on aircraft elevators                                     |    |
| 3.6 | Loads on ammunition elevators                                   |    |
| 4   | Hull girder strength                                            | 35 |
| 4.1 | Strength characteristics of the hull girder transverse sections |    |
| 4.2 | Yielding check                                                  |    |
| 5   | Hull scantlings of flight deck                                  | 36 |
| 5.1 | General                                                         |    |
| 5.2 | Plating                                                         |    |
| 5.3 | Ordinary stiffeners                                             |    |
| 5.4 | Primary supporting structure                                    |    |

|          |                              |           |
|----------|------------------------------|-----------|
| <b>6</b> | <b>Sponsons</b>              | <b>36</b> |
| 6.1      | Side shell                   |           |
| 6.2      | Front wall and aft wall      |           |
| 6.3      | Underside                    |           |
| <b>7</b> | <b>Other hull scantlings</b> | <b>37</b> |
| 7.1      | Bottom                       |           |
| 7.2      | Hangar                       |           |
| 7.3      | Island and bridge            |           |
| 7.4      | Aircraft elevators           |           |
| 7.5      | Ammunition elevators         |           |
| <b>8</b> | <b>Hull outfitting</b>       | <b>38</b> |
| 8.1      | Anchoring equipment          |           |
| 8.2      | Towing arrangement           |           |
| <b>9</b> | <b>Fatigue analysis</b>      | <b>38</b> |
| 9.1      | Structural details           |           |

### **Section 3 Machinery and Systems**

|          |                               |           |
|----------|-------------------------------|-----------|
| <b>1</b> | <b>General</b>                | <b>39</b> |
| 1.1      | Application                   |           |
| <b>2</b> | <b>Main propulsion</b>        | <b>39</b> |
| 2.1      | Availability                  |           |
| <b>3</b> | <b>Steering system</b>        | <b>39</b> |
| 3.1      | Availability                  |           |
| <b>4</b> | <b>Stabilization system</b>   | <b>39</b> |
| 4.1      | General                       |           |
| <b>5</b> | <b>Heel correction system</b> | <b>39</b> |
| 5.1      | General                       |           |
| <b>6</b> | <b>Aircraft launching</b>     | <b>39</b> |
| 6.1      | Take off facilities           |           |
| <b>7</b> | <b>Aircraft recovery</b>      | <b>40</b> |
| 7.1      | Landing facilities            |           |
| <b>8</b> | <b>Aircraft handling</b>      | <b>40</b> |
| 8.1      | Internal movements            |           |
| <b>9</b> | <b>Aircraft supplying</b>     | <b>40</b> |
| 9.1      | General                       |           |

### **Section 4 Electrical Installations**

|          |                               |           |
|----------|-------------------------------|-----------|
| <b>1</b> | <b>General</b>                | <b>41</b> |
| 1.1      | Applicability                 |           |
| 1.2      | Documentation to be submitted |           |

|          |                                                                         |           |
|----------|-------------------------------------------------------------------------|-----------|
| <b>2</b> | <b>Design of electrical installation</b>                                | <b>41</b> |
| 2.1      | Harmonic distortions                                                    |           |
| 2.2      | Essential services                                                      |           |
| 2.3      | Power supply                                                            |           |
| 2.4      | Main switchboard                                                        |           |
| 2.5      | Emergency switchboard                                                   |           |
| 2.6      | Shore supply                                                            |           |
| 2.7      | Electrical equipment located in dangerous areas                         |           |
| 2.8      | Electrical equipment located in special spaces                          |           |
| 2.9      | Electrical equipment related to aircrafts services                      |           |
| <b>3</b> | <b>Emergency source of electrical power and emergency installations</b> | <b>43</b> |
| 3.1      | General                                                                 |           |
| 3.2      | Distribution of electrical power                                        |           |
| 3.3      | Low-location lighting                                                   |           |
| <b>4</b> | <b>General emergency alarm and public address systems</b>               | <b>46</b> |
| 4.1      | General emergency alarm system                                          |           |
| 4.2      | Public address system                                                   |           |
| 4.3      | Combined general emergency alarm - Public address system                |           |
| <b>5</b> | <b>Automation</b>                                                       | <b>48</b> |
| 5.1      | Alarms and safeties related to steam generation for catapults           |           |
| 5.2      | Propulsion and heading control                                          |           |
| 5.3      | Data transmission link                                                  |           |
| 5.4      | Wheelhouse arrangement                                                  |           |

## Section 5 Fire Protection

|          |                                                    |           |
|----------|----------------------------------------------------|-----------|
| <b>1</b> | <b>General</b>                                     | <b>49</b> |
| 1.1      | Application                                        |           |
| 1.2      | Documents to be submitted                          |           |
| <b>2</b> | <b>General requirements</b>                        | <b>49</b> |
| 2.1      | Vertical subdivisions                              |           |
| 2.2      | Horizontal subdivisions                            |           |
| 2.3      | Damage control stations                            |           |
| <b>3</b> | <b>Containment of fire</b>                         | <b>51</b> |
| 3.1      | Fire integrity of bulkheads and decks              |           |
| 3.2      | Protection of openings in fire-resistant divisions |           |
| 3.3      | Ventilation                                        |           |
| <b>4</b> | <b>Fire-extinguishing</b>                          | <b>54</b> |
| 4.1      | Fire pump capacity                                 |           |
| 4.2      | Sprinkler installation                             |           |
| 4.3      | Flight decks                                       |           |
| <b>5</b> | <b>Evacuation</b>                                  | <b>54</b> |
| 5.1      | General                                            |           |
| 5.2      | Dispensation and application                       |           |
| 5.3      | Distribution of persons                            |           |

|     |                                            |    |
|-----|--------------------------------------------|----|
| 6   | Aircraft hangars                           | 56 |
| 6.1 | General                                    |    |
| 6.2 | Operational                                |    |
| 6.3 | Fire protection                            |    |
| 6.4 | Rooms for testing the airplane reactors    |    |
| 7   | Oxygen production                          | 57 |
| 7.1 | Oxygen production and storage installation |    |

**Section 6    Aircraft Facilities**

|     |                              |    |
|-----|------------------------------|----|
| 1   | Operational requirements     | 58 |
| 1.1 | Aviation fire-fighters teams |    |

# CHAPTER 3

## CORVETTE

### Section 1 General

|     |               |    |
|-----|---------------|----|
| 1   | General       | 61 |
| 1.1 | Application   |    |
| 1.2 | Summary table |    |

### Section 2 Hull

|     |                                                                     |    |
|-----|---------------------------------------------------------------------|----|
| 1   | General                                                             | 62 |
| 1.1 | Application                                                         |    |
| 1.2 | Gross scantling approach                                            |    |
| 1.3 | Corrosion protection - Heterogeneous steel/aluminium alloy assembly |    |
| 2   | Structure design principles                                         | 62 |
| 2.1 | Vertical acceleration at LCG                                        |    |
| 2.2 | Transverse acceleration                                             |    |
| 2.3 | Operating conditions                                                |    |
| 3   | Hull girder strength                                                | 64 |
| 3.1 | Hull girder loads                                                   |    |
| 3.2 | Yielding check                                                      |    |
| 4   | Local loads                                                         | 66 |
| 4.1 | Introduction                                                        |    |
| 4.2 | Loads                                                               |    |
| 4.3 | Impact pressure on the bottom                                       |    |
| 4.4 | Sea pressures                                                       |    |
| 4.5 | Sea pressures on deckhouses                                         |    |
| 4.6 | Deck loads                                                          |    |
| 4.7 | Pressures on tank structures                                        |    |
| 5   | Hull scantlings                                                     | 69 |
| 5.1 | Plating                                                             |    |
| 5.2 | Ordinary stiffeners                                                 |    |
| 5.3 | Primary members                                                     |    |
| 5.4 | Direct calculation                                                  |    |
| 6   | Hull outfitting                                                     | 71 |
| 6.1 | Anchoring equipment                                                 |    |
| 6.2 | Rudders                                                             |    |
| 6.3 | Waterjets                                                           |    |
| 6.4 | Hull appendages - Propeller shaft brackets                          |    |
| 7   | Fatigue                                                             | 72 |
| 7.1 |                                                                     |    |

### Section 3 Machinery and Systems

|   |                 |    |
|---|-----------------|----|
| 1 | General         | 73 |
|   | 1.1 Application |    |
| 2 | Gearing         | 73 |
|   | 2.1 General     |    |

### Section 4 Electrical Installations

|   |                 |    |
|---|-----------------|----|
| 1 | General         | 74 |
|   | 1.1 Application |    |

### Section 5 Fire Protection

|   |                                                                                         |    |
|---|-----------------------------------------------------------------------------------------|----|
| 1 | General                                                                                 | 75 |
|   | 1.1 Application                                                                         |    |
|   | 1.2 Definitions                                                                         |    |
| 2 | Suppression of fire and explosion Containment of fire                                   | 76 |
|   | 2.1 Damage control stations                                                             |    |
|   | 2.2 Ship subdivision                                                                    |    |
|   | 2.3 Ventilation systems                                                                 |    |
| 3 | Suppression of fire and explosion Fire-fighting                                         | 76 |
|   | 3.1 Fire pumps                                                                          |    |
|   | 3.2 Firefighter's outfits                                                               |    |
| 4 | Escape and circulation                                                                  | 77 |
|   | 4.1 Means of escape                                                                     |    |
|   | 4.2 Evacuation stations                                                                 |    |
|   | 4.3 Width of escape routes                                                              |    |
| 5 | Protection of vehicle and ro-ro spaces                                                  | 78 |
|   | 5.1 Precaution against ignition of flammable vapours in closed vehicle and ro-ro spaces |    |

# CHAPTER 4

## AUXILIARY NAVAL VESSEL

### Section 1 General

|     |               |    |
|-----|---------------|----|
| 1   | General       | 81 |
| 1.1 | Application   |    |
| 1.2 | Summary table |    |
| 1.3 | Definitions   |    |

### Section 2 Ship Arrangement

|     |                                                                                |    |
|-----|--------------------------------------------------------------------------------|----|
| 1   | General                                                                        | 84 |
| 1.1 | Documents to be submitted                                                      |    |
| 2   | Definitions                                                                    | 84 |
| 2.1 | Deadweight                                                                     |    |
| 3   | Ship arrangement                                                               | 84 |
| 3.1 | Double bottom arrangement outside of cargo area                                |    |
| 3.2 | Openings in watertight bulkheads below the bulkhead deck                       |    |
| 4   | General arrangement of the ship with regard to fire prevention and crew safety | 88 |
| 4.1 | Location and separation of spaces                                              |    |
| 4.2 | Access and openings                                                            |    |
| 4.3 | Ventilation                                                                    |    |
| 5   | General arrangement of the ship with regard to pollution prevention            | 89 |
| 5.1 | Protection of the cargo tank length in the event of grounding or collision     |    |
| 5.2 | Segregation of oil and water ballast                                           |    |
| 5.3 | Accidental oil outflow performance                                             |    |
| 5.4 | Retention of oil on board - Slop tanks                                         |    |
| 5.5 | Deck spills                                                                    |    |
| 5.6 | Pump-room bottom protection                                                    |    |

### Section 3 Hull and Stability

|     |                     |    |
|-----|---------------------|----|
| 1   | General             | 92 |
| 1.1 | Application         |    |
| 2   | Stability           | 92 |
| 2.1 | Intact stability    |    |
| 2.2 | Damage stability    |    |
| 3   | Loading conditions  | 94 |
| 3.1 | Propeller immersion |    |

|          |                                      |           |
|----------|--------------------------------------|-----------|
| <b>4</b> | <b>Structure</b>                     | <b>94</b> |
| 4.1      | Application                          |           |
| 4.2      | Hull scantlings                      |           |
| 4.3      | Ammunitions and dry stores elevators |           |

## Section 4 Machinery and Systems

|          |                                                      |            |
|----------|------------------------------------------------------|------------|
| <b>1</b> | <b>General</b>                                       | <b>96</b>  |
| 1.1      | Application                                          |            |
| 1.2      | Documents to be submitted                            |            |
| <b>2</b> | <b>Propulsion and steering capability</b>            | <b>96</b>  |
| 2.1      | Propulsion availability                              |            |
| 2.2      | Steering                                             |            |
| <b>3</b> | <b>Piping systems other than cargo piping system</b> | <b>96</b>  |
| 3.1      | General                                              |            |
| 3.2      | Bilge system                                         |            |
| 3.3      | Ballast system                                       |            |
| 3.4      | Scupper pipes                                        |            |
| 3.5      | Arrangement for JP5-NATO (F44) and Fuel oil systems  |            |
| 3.6      | Heating systems                                      |            |
| 3.7      | Heating systems intended for cargo                   |            |
| <b>4</b> | <b>Cargo pumping and piping systems</b>              | <b>98</b>  |
| 4.1      | General                                              |            |
| 4.2      | Cargo pumping system                                 |            |
| 4.3      | Cargo piping design                                  |            |
| 4.4      | Cargo piping arrangement and installation            |            |
| 4.5      | Arrangement of cargo pump rooms                      |            |
| <b>5</b> | <b>Cargo tanks and fittings</b>                      | <b>101</b> |
| 5.1      | Application                                          |            |
| 5.2      | Cargo tank venting                                   |            |
| 5.3      | Cargo tank inerting, purging and/or gas-freeing      |            |
| 5.4      | Cargo tank level gauging systems                     |            |
| 5.5      | Protection against tank overfilling                  |            |
| 5.6      | Tank washing systems                                 |            |
| <b>6</b> | <b>Prevention of pollution by cargo oil</b>          | <b>102</b> |
| 6.1      | General                                              |            |
| 6.2      | Oil discharge monitoring and control system          |            |
| 6.3      | Pumping, piping and discharge arrangements           |            |
| <b>7</b> | <b>Certification, inspection and testing</b>         | <b>103</b> |
| 7.1      | Application                                          |            |
| 7.2      | Workshop tests                                       |            |
| 7.3      | Shipboard tests                                      |            |
| <b>8</b> | <b>Dry stores and ammunition handling</b>            | <b>103</b> |
| 8.1      | Internal movements                                   |            |

## Section 5 Electrical Installations

|          |                                                                               |            |
|----------|-------------------------------------------------------------------------------|------------|
| <b>1</b> | <b>General</b>                                                                | <b>105</b> |
| 1.1      | Application                                                                   |            |
| 1.2      | Essential services                                                            |            |
| 1.3      | Documentation to be submitted                                                 |            |
| 1.4      | System of supply                                                              |            |
| 1.5      | Electrical distribution and protection                                        |            |
| 1.6      | Earth detection                                                               |            |
| 1.7      | Mechanical ventilation of hazardous spaces                                    |            |
| 1.8      | Electrical installation precautions                                           |            |
| <b>2</b> | <b>Hazardous locations and types of equipment</b>                             | <b>106</b> |
| 2.1      |                                                                               |            |
| <b>3</b> | <b>Emergency distribution of electrical power and emergency installations</b> | <b>106</b> |
| 3.1      | Distribution of electrical power                                              |            |
| 3.2      | Low-location lighting                                                         |            |
| <b>4</b> | <b>Internal communications</b>                                                | <b>108</b> |
| 4.1      | General                                                                       |            |
| 4.2      | General emergency alarm system                                                |            |
| 4.3      | Public address system                                                         |            |
| 4.4      | Combined general emergency alarm - public address system                      |            |
| 4.5      | Quality failure analysis                                                      |            |
| <b>5</b> | <b>Installation</b>                                                           | <b>110</b> |
| 5.1      | Section and distribution boards                                               |            |
| <b>6</b> | <b>Type approved components</b>                                               | <b>110</b> |
| 6.1      |                                                                               |            |

## Section 6 Fire Protection

|          |                                                                     |            |
|----------|---------------------------------------------------------------------|------------|
| <b>1</b> | <b>General</b>                                                      | <b>111</b> |
| 1.1      | Application                                                         |            |
| 1.2      | Documents to be submitted                                           |            |
| <b>2</b> | <b>General requirements</b>                                         | <b>111</b> |
| 2.1      | Sources of ignition                                                 |            |
| <b>3</b> | <b>Detection and alarm</b>                                          | <b>111</b> |
| 3.1      | Protection of machinery spaces                                      |            |
| 3.2      | Protection of accommodation and service spaces and control stations |            |
| 3.3      | Protection of ammunitions spaces                                    |            |
| <b>4</b> | <b>Containment of fire</b>                                          | <b>112</b> |
| 4.1      | Thermal and structural subdivision                                  |            |
| 4.2      | Capacity of the ventilation systems                                 |            |
| <b>5</b> | <b>Fire fighting</b>                                                | <b>116</b> |
| 5.1      | Fire mains and hydrants                                             |            |
| 5.2      | Type of fixed fire-extinguishing systems                            |            |
| 5.3      | Fire-extinguishing systems for cargo pump rooms                     |            |

|          |                                                                                       |            |
|----------|---------------------------------------------------------------------------------------|------------|
| 5.4      | Fire-extinguishing systems for ammunition spaces                                      |            |
| 5.5      | Fire-extinguishing systems for ammunition and dry stores transfer routes              |            |
| 5.6      | Fire-extinguishing arrangements in control stations, accommodation and service spaces |            |
| 5.7      | Protection of JP5 pump rooms                                                          |            |
| <b>6</b> | <b>Fixed deck foam system</b>                                                         | <b>118</b> |
| 6.1      | Application                                                                           |            |
| 6.2      | System design                                                                         |            |
| 6.3      | Arrangement and installation                                                          |            |
| <b>7</b> | <b>Inert gas systems</b>                                                              | <b>119</b> |
| 7.1      | Application                                                                           |            |
| 7.2      | General                                                                               |            |
| 7.3      | Principles                                                                            |            |
| 7.4      | Design and arrangement of the system                                                  |            |
| 7.5      | Additional requirements                                                               |            |
| <b>8</b> | <b>Equipment for measuring oxygen and flammable vapours concentration</b>             | <b>123</b> |
| 8.1      | Provisions applicable to all ships                                                    |            |

## Section 7 Escape

|          |                                                                                |            |
|----------|--------------------------------------------------------------------------------|------------|
| <b>1</b> | <b>General</b>                                                                 | <b>124</b> |
| 1.1      | Application                                                                    |            |
| <b>2</b> | <b>Means of escape</b>                                                         | <b>124</b> |
| 2.1      | Means of escape from control stations, accommodation spaces and service spaces |            |

## Section 8 Replenishment at Sea

|          |                                     |            |
|----------|-------------------------------------|------------|
| <b>1</b> | <b>General</b>                      | <b>126</b> |
| 1.1      | Application                         |            |
| 1.2      | Documents to be submitted           |            |
| 1.3      | Definitions                         |            |
| 1.4      | Standardization                     |            |
| <b>2</b> | <b>Design and construction</b>      | <b>127</b> |
| 2.1      | RAS equipment                       |            |
| 2.2      | Steering capability                 |            |
| <b>3</b> | <b>Arrangement and installation</b> | <b>129</b> |
| 3.1      | General                             |            |
| 3.2      | Arrangement of RAS stations         |            |
| 3.3      | Communication                       |            |
| 3.4      | RAS station arrangement             |            |
| 3.5      | RAS control station arrangement     |            |
| 3.6      | Fluid transfer                      |            |
| 3.7      | Solid transfer                      |            |
| 3.8      | VERTREP                             |            |
| 3.9      | Night RAS operation                 |            |

|          |                                              |            |
|----------|----------------------------------------------|------------|
| <b>4</b> | <b>Certification, inspection and testing</b> | <b>130</b> |
| 4.1      | Type approval procedure                      |            |
| 4.2      | Inspection at works of the RAS equipment     |            |
| 4.3      | Prototype tests                              |            |
| 4.4      | Tests on board                               |            |

## **Section 9 Carriage of Limited Quantities of Flammable Products with Flashpoint ≤ 60°C**

|          |                                                             |            |
|----------|-------------------------------------------------------------|------------|
| <b>1</b> | <b>General</b>                                              | <b>133</b> |
| 1.1      | Application                                                 |            |
| 1.2      | Maximum capacity of flammable liquid with flashpoint ≤ 60°C |            |
| 1.3      | Definitions                                                 |            |
| <b>2</b> | <b>General arrangement</b>                                  | <b>133</b> |
| 2.1      | Compartment arrangement                                     |            |
| 2.2      | Access arrangements                                         |            |
| <b>3</b> | <b>Machinery systems</b>                                    | <b>134</b> |
| 3.1      | Bilge system                                                |            |
| 3.2      | Other piping systems not intended for cargo                 |            |
| <b>4</b> | <b>Cargo systems</b>                                        | <b>134</b> |
| 4.1      | Cargo segregation                                           |            |
| 4.2      | Materials                                                   |            |
| 4.3      | Installation of independent portable tanks                  |            |
| 4.4      | Cargo pumping system, piping system and pump rooms          |            |
| 4.5      | Cargo tanks and cargo storage vessels                       |            |
| <b>5</b> | <b>Electrical installations</b>                             | <b>136</b> |
| 5.1      | Hazardous locations and types of equipment                  |            |

# CHAPTER 5

## AMPHIBIOUS VESSEL

### Section 1 General

|     |               |     |
|-----|---------------|-----|
| 1   | General       | 139 |
| 1.1 | Application   |     |
| 1.2 | Summary table |     |
| 1.3 | Definitions   |     |

### Section 2 Ship Arrangement

|     |                                                           |     |
|-----|-----------------------------------------------------------|-----|
| 1   | General                                                   | 141 |
| 1.1 | Documents to be submitted                                 |     |
| 2   | Ship arrangement                                          | 141 |
| 2.1 | Well dock arrangement                                     |     |
| 2.2 | Well dock watertight/weathertight boundaries              |     |
| 2.3 | Number and disposition of transverse watertight bulkheads |     |

### Section 3 Hull and Stability

|     |                                                                                                |     |
|-----|------------------------------------------------------------------------------------------------|-----|
| 1   | General                                                                                        | 142 |
| 1.1 | Application                                                                                    |     |
| 2   | Intact and damage stability in transit                                                         | 142 |
| 2.1 | General                                                                                        |     |
| 3   | Intact stability requirements for the well dock into operation                                 | 142 |
| 3.1 | General intact stability criteria                                                              |     |
| 3.2 | Severe wind and rolling criteria                                                               |     |
| 3.3 | Ice accretion                                                                                  |     |
| 3.4 | Crowding of embarked troops                                                                    |     |
| 4   | Damage stability requirements for the well dock into operation                                 | 142 |
| 4.1 | General                                                                                        |     |
| 4.2 | Damage definition                                                                              |     |
| 4.3 | Damage stability criteria at the final stage of flooding and after equalization                |     |
| 4.4 | Damage stability criteria at the intermediate stages of flooding including before equalization |     |
| 5   | Loading conditions                                                                             | 143 |
| 5.1 | Well dock operation                                                                            |     |
| 6   | Structure design principles                                                                    | 143 |
| 6.1 | General information                                                                            |     |
| 6.2 | Well dock                                                                                      |     |
| 6.3 | Flight deck                                                                                    |     |
| 6.4 | Hangar                                                                                         |     |

|          |                               |            |
|----------|-------------------------------|------------|
| 6.5      | Accommodation spaces          |            |
| 6.6      | Aircraft elevators            |            |
| 6.7      | Ammunition elevators          |            |
| <b>7</b> | <b>Design loads</b>           | <b>145</b> |
| 7.1      | Loads in well dock            |            |
| 7.2      | Loads on flight deck          |            |
| 7.3      | Loads on island and bridge    |            |
| 7.4      | Loads on hangar decks         |            |
| 7.5      | Loads in accommodation spaces |            |
| 7.6      | Loads on aircraft elevators   |            |
| 7.7      | Loads on ammunition elevators |            |
| <b>8</b> | <b>Hull scantling</b>         | <b>148</b> |
| 8.1      | Well dock                     |            |
| 8.2      | Flight deck                   |            |
| 8.3      | Sponsons                      |            |
| 8.4      | Island and bridge             |            |
| 8.5      | Hangar                        |            |
| 8.6      | Accommodation spaces          |            |
| 8.7      | Aircraft elevators            |            |
| 8.8      | Ammunition elevators          |            |
| 8.9      | Transfer routes               |            |

## Section 4 Machinery and Systems

|          |                                                                 |            |
|----------|-----------------------------------------------------------------|------------|
| <b>1</b> | <b>General</b>                                                  | <b>151</b> |
| 1.1      | Application                                                     |            |
| <b>2</b> | <b>Main propulsion</b>                                          | <b>151</b> |
| 2.1      | Availability                                                    |            |
| <b>3</b> | <b>Well dock systems</b>                                        | <b>151</b> |
| 3.1      | Ballast system dedicated to well dock operation                 |            |
| 3.2      | Drainage of well dock                                           |            |
| 3.3      | Control and monitoring of ballast system dedicated to well dock |            |
| <b>4</b> | <b>Aircraft handling</b>                                        | <b>152</b> |
| 4.1      | Internal movements                                              |            |
| <b>5</b> | <b>Aircraft supplying</b>                                       | <b>152</b> |
| 5.1      | General                                                         |            |

## Section 5 Electrical Installations

|          |                                        |            |
|----------|----------------------------------------|------------|
| <b>1</b> | <b>General</b>                         | <b>153</b> |
| 1.1      | Applicable requirements                |            |
| 1.2      | Documentation to be submitted          |            |
| 1.3      | Electrical distribution and protection |            |

|          |                                                                                                               |            |
|----------|---------------------------------------------------------------------------------------------------------------|------------|
| <b>2</b> | <b>Emergency source of electrical power and emergency installations</b>                                       | <b>153</b> |
| 2.1      | General                                                                                                       |            |
| 2.2      | Distribution of electrical power                                                                              |            |
| 2.3      | Low-location lighting                                                                                         |            |
| 2.4      | Supplementary emergency lighting                                                                              |            |
| 2.5      | Emergency lighting in cabins                                                                                  |            |
| <b>3</b> | <b>General emergency alarm and public address systems</b>                                                     | <b>157</b> |
| 3.1      | General emergency alarm system                                                                                |            |
| 3.2      | Public address system                                                                                         |            |
| 3.3      | Combined general emergency alarm - public address system                                                      |            |
| <b>4</b> | <b>Installation</b>                                                                                           | <b>158</b> |
| 4.1      | Electrical equipment located in special spaces                                                                |            |
| 4.2      | Installations in special category spaces situated above the bulkhead deck                                     |            |
| 4.3      | Installations in special category spaces situated below the bulkhead deck                                     |            |
| 4.4      | Installations in petrol spaces other than special category spaces intended for the carriage of motor vehicles |            |
| 4.5      | Electrical installation in well-dock space                                                                    |            |
| 4.6      | Wheelhouse arrangement                                                                                        |            |
| <b>5</b> | <b>Type approved components</b>                                                                               | <b>160</b> |
| 5.1      |                                                                                                               |            |

## **Section 6 Fire Protection**

|          |                                                    |            |
|----------|----------------------------------------------------|------------|
| <b>1</b> | <b>General</b>                                     | <b>161</b> |
| 1.1      | Application                                        |            |
| 1.2      | Documents to be submitted                          |            |
| <b>2</b> | <b>General requirements</b>                        | <b>161</b> |
| 2.1      | Vertical subdivisions                              |            |
| 2.2      | Horizontal subdivisions                            |            |
| 2.3      | Damage control stations                            |            |
| <b>3</b> | <b>Containment of fire</b>                         | <b>161</b> |
| 3.1      | Fire integrity of bulkheads and decks              |            |
| 3.2      | Protection of openings in fire-resistant divisions |            |
| 3.3      | Ventilation                                        |            |
| <b>4</b> | <b>Fire-extinguishing arrangement</b>              | <b>165</b> |
| 4.1      | Fire pump capacity                                 |            |
| 4.2      | Sprinkler installation                             |            |
| <b>5</b> | <b>Flight decks</b>                                | <b>165</b> |
| 5.1      | General                                            |            |
| <b>6</b> | <b>Well docks</b>                                  | <b>165</b> |
| 6.1      | General                                            |            |
| <b>7</b> | <b>Ro-ro spaces</b>                                | <b>165</b> |
| 7.1      | General                                            |            |

|          |                                            |            |
|----------|--------------------------------------------|------------|
| <b>8</b> | <b>Aircraft hangars</b>                    | <b>165</b> |
| 8.1      | General                                    |            |
| 8.2      | Operational                                |            |
| 8.3      | Fire protection                            |            |
| <b>9</b> | <b>Oxygen production</b>                   | <b>166</b> |
| 9.1      | Oxygen production and storage installation |            |

## Section 7 Escape

|          |                              |            |
|----------|------------------------------|------------|
| <b>1</b> | <b>General</b>               | <b>167</b> |
| 1.1      | Application                  |            |
| 1.2      | Dispensation and application |            |
| 1.3      | Distribution of persons      |            |

## Section 8 Facilities for Flammable Products with Flashpoint $\leq 60^{\circ}\text{C}$

|          |                                                                                |            |
|----------|--------------------------------------------------------------------------------|------------|
| <b>1</b> | <b>General</b>                                                                 | <b>170</b> |
| 1.1      | Application                                                                    |            |
| 1.2      | Maximum capacity of flammable liquid with flashpoint $\leq 60^{\circ}\text{C}$ |            |
| 1.3      | Definitions                                                                    |            |
| <b>2</b> | <b>General arrangement</b>                                                     | <b>171</b> |
| 2.1      | Compartment arrangement                                                        |            |
| 2.2      | Access arrangement                                                             |            |
| 2.3      | Petrol tanks                                                                   |            |
| 2.4      | Cofferdam                                                                      |            |
| <b>3</b> | <b>Bilge</b>                                                                   | <b>172</b> |
| 3.1      | Bilge system                                                                   |            |
| <b>4</b> | <b>Petrol system</b>                                                           | <b>172</b> |
| 4.1      | Petrol tanks                                                                   |            |
| 4.2      | Petrol delivery system                                                         |            |
| 4.3      | Petrol pump room                                                               |            |
| <b>5</b> | <b>Petrol delivery facilities</b>                                              | <b>173</b> |
| 5.1      | General                                                                        |            |
| 5.2      | Arrangement                                                                    |            |
| 5.3      | Ventilation                                                                    |            |
| <b>6</b> | <b>Fire and gas protection</b>                                                 | <b>173</b> |
| 6.1      | Fire fighting system                                                           |            |
| 6.2      | Fire and gas detection system                                                  |            |
| <b>7</b> | <b>Electrical installations</b>                                                | <b>173</b> |
| 7.1      | Hazardous locations and types of equipment                                     |            |
| <b>8</b> | <b>Operation manual</b>                                                        | <b>174</b> |
| 8.1      | General                                                                        |            |

# CHAPTER 6

## MILITARY OFFSHORE PATROL VESSEL

### Section 1 General

|     |                                 |     |
|-----|---------------------------------|-----|
| 1   | General                         | 177 |
| 1.1 | Application                     |     |
| 1.2 | Definitions                     |     |
| 1.3 | Summary table                   |     |
| 2   | Double bottoms                  | 177 |
| 2.1 | General                         |     |
| 3   | Doors in watertight bulkheads   | 178 |
| 3.1 | Application                     |     |
| 3.2 | Doors below the watertight deck |     |

### Section 2 Hull and Stability

|     |                                                                                          |     |
|-----|------------------------------------------------------------------------------------------|-----|
| 1   | General                                                                                  | 179 |
| 1.1 | Application                                                                              |     |
| 2   | Stability                                                                                | 179 |
| 2.1 | General                                                                                  |     |
| 2.2 | Intact stability                                                                         |     |
| 2.3 | Damage stability                                                                         |     |
| 3   | Structure                                                                                | 179 |
| 3.1 | Structure in way of weapons systems - All vessels                                        |     |
| 3.2 | Aft ramp - All vessels                                                                   |     |
| 3.3 | Deck structure in way of launching appliances used for special force craft - All vessels |     |
| 3.4 | Vessels with length more than 24 m and less than 60 m                                    |     |
| 3.5 | Vessels with length less than or equal to 24 m                                           |     |

### Section 3 Machinery and Systems

|     |                                                            |     |
|-----|------------------------------------------------------------|-----|
| 1   | General                                                    | 181 |
| 1.1 | Application                                                |     |
| 2   | Additional requirements for OPV with length less than 60 m | 181 |
| 2.1 | Prevention of progressive flooding                         |     |
| 2.2 | Bilge pumping arrangement                                  |     |
| 2.3 | Capacity of fuel oil service tanks                         |     |

**Section 4    Electrical Installations and automation**

|          |                |            |
|----------|----------------|------------|
| <b>1</b> | <b>General</b> | <b>182</b> |
| 1.1      | Application    |            |

**Section 5    Fire Protection**

|          |                                                                                |            |
|----------|--------------------------------------------------------------------------------|------------|
| <b>1</b> | <b>General</b>                                                                 | <b>183</b> |
| 1.1      | Application                                                                    |            |
| 1.2      | Definitions                                                                    |            |
| <b>2</b> | <b>Suppression of fire</b>                                                     | <b>183</b> |
| 2.1      | Detection and alarm                                                            |            |
| 2.2      | Fire containment                                                               |            |
| 2.3      | Fire fighting                                                                  |            |
| <b>3</b> | <b>Escape and circulation</b>                                                  | <b>184</b> |
| 3.1      | Application                                                                    |            |
| 3.2      | Means of escape from control stations, accommodation spaces and service spaces |            |

Part D  
**Service Notations**

Chapter 1  
**FRIGATE**

---

|                  |                                 |
|------------------|---------------------------------|
| <b>SECTION 1</b> | <b>GENERAL</b>                  |
| <b>SECTION 2</b> | <b>MACHINERY AND SYSTEMS</b>    |
| <b>SECTION 3</b> | <b>ELECTRICAL INSTALLATIONS</b> |
| <b>SECTION 4</b> | <b>FIRE PROTECTION</b>          |



SECTION 1

GENERAL

1 General

1.1 Application

1.1.1 Ships complying with the requirements of this Chapter are eligible for the assignment of the service notation **Frigate**, as defined in Pt A, Ch 1, Sec 2, [4.2.1].

1.1.2 The Sections of this Chapter containing additional requirements for frigates are indicated in Tab 1.

1.2 Summary table

1.2.1 Ships dealt with in this Chapter are to comply with the requirements stipulated in Part A, Part B, Part C of the Rules and in NR216 Materials, as applicable, and with the requirements of this Chapter, which are specific to frigates.

Table 1 :

| Main subject                                                                     | Reference   |
|----------------------------------------------------------------------------------|-------------|
| Ship arrangement                                                                 | (1)         |
| Hull and stability                                                               | (1)         |
| Machinery and systems                                                            | Ch 1, Sec 2 |
| Electrical installations                                                         | Ch 1, Sec 3 |
| Fire protection, detection and extinction                                        | Ch 1, Sec 4 |
| (1) The Rules do not contain specific requirements for frigates on this subject. |             |

SECTION 2

MACHINERY AND SYSTEMS

1 General

1.1 Application

1.1.1 Ships having the **Frigate** notation are to comply with the general requirements of Part C, Chapter 1. In addition they are to comply with the provisions of this Section.

2 Main propulsion

2.1 Availability

2.1.1 According to the mission of this type of ships, a special consideration will be given to the general arrangement of the main propulsion.  
Therefore the main propulsion system is to comply at least with the requirements of the additional class notation **AVM-APM** as defined in Pt E, Ch 3, Sec 1.

SECTION 3

ELECTRICAL INSTALLATIONS

1 General

1.1 Applicability

**1.1.1** In addition to the requirements given in Part C, Chapter 2 and Part C, Chapter 3, the following requirements are applicable for ships having the **Frigate** notation.

For weapons and sensors which are not considered within classification scope as essential services according to [2.1], all the electrical installations (electrical generators, main power sources, cable networks) up to and including the secondary switchboards are concerned by this Chapter. Nevertheless each weapon or sensor is considered as potential source of ignition and then requirements concerning electrical monitoring and safety devices/systems for fire protection are applicable.

1.2 Environmental conditions

**1.2.1** Pt C, Ch 2, Sec 1, Tab 4 is to be replaced by Tab 1 of this Section.

2 Design of electrical installation

2.1 Essential services

**2.1.1** In complement of the requirements of Pt C, Ch 2, Sec 1, [3.4], the following services are to be considered as secondary essential services:

- combat management systems
- weapons and sensors, including signature control and aviation systems, only considered as potential sources of ignition

- command and control systems integrated in the bridge or damage control stations
- internal and external communications systems required in the present Rules
- command and control equipment of locally operated safety systems
- boats launching and crew recovery systems.

**2.1.2** Services for habitability are those intended for minimum comfort conditions for people on board, and specially in engine control room, safety room and operation control room.

Examples of equipment for maintaining conditions of habitability:

- lightning (50%)
- galleys (75%)
- mechanical ventilation (50%)
- heating and air conditioning (≥ 50%)
- refrigerated stores (100%)
- hospital (100%)
- drinking water production (100%)
- electric generators and associated power sources supplying the above equipment.

2.2 Specific power supply

**2.2.1** Power supply to weapons and sensors, and combat management systems are to be designed so as to comply with the requirements of STANAG 1008.

**2.2.2** In addition to the requirements of Pt C, Ch 2, Sec 3, [3.6], high voltage may be used for shore supply.

Table 1 : Second characteristic numeral

| Second characteristic numeral | Brief description of location                                                                     | Frequency range (Hz)                 | Displacement amplitude (mm) | Acceleration amplitude g |
|-------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------|-----------------------------|--------------------------|
| 1                             | Machinery spaces, command and control stations, accommodation spaces, exposed decks, cargo spaces | from 2,0 to 13,2<br>from 13,2 to 100 | 1,0<br>–                    | –<br>0,7                 |
| 2                             | Masts                                                                                             | from 2,0 to 13,2<br>from 13,2 to 50  | 3,0<br>–                    | –<br>2,1                 |
| 3                             | On air compressors, on diesel engines and similar                                                 | from 2,0 to 25,0<br>from 25,0 to 100 | 1,6<br>–                    | –<br>4,0                 |

SECTION 4

FIRE PROTECTION

1 General

1.1 Application

1.1.1 Unless otherwise specified, the provisions of this Section apply to the ships having the following service notation:

- Frigate

1.1.2 The following provisions apply in addition to the requirements of Part C, Chapter 4.

1.2 Documents to be submitted

1.2.1 The interested party is to submit to the Society the documents listed in Tab 1.

2 General requirements

2.1 Ship subdivisions

2.1.1 The ship shall be divided in at least two safety zones.

Note 1: If the part of the ship located forward the collision bulkhead forms one main vertical zone, this main vertical zone need not to comply with the requirements of Pt C, Ch 4, Sec 5, [6.2.2] item d) and Pt C, Ch 4, Sec 6, [1.3.2].

2.1.2 The bulkheads forming the boundaries of the safety zones shall be in line with the main vertical zone bulkheads.

Table 1 : Documentation to be submitted

| No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | I/A (1) | Document (2)                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | A       | Structural fire protection showing the purpose of the various spaces of the ships, the fire rating of bulkheads and decks, means of closings of openings in A and B class divisions, draught stops, and completed with the indication of material of other bulkhead and of ceilings and lining |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | A       | Natural and mechanical ventilation systems showing the penetrations on A class divisions, location of dampers, means of closing, arrangements of air conditioning rooms                                                                                                                        |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | A       | Means of escape and access to spaces                                                                                                                                                                                                                                                           |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | A       | Automatic fire detection systems and manually operated call points                                                                                                                                                                                                                             |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | A       | Fire pumps and fire main including pumps head and capacity, hydrant and hose locations (2)                                                                                                                                                                                                     |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | A       | Arrangement of fixed fire-extinguishing systems (2)                                                                                                                                                                                                                                            |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | A       | Arrangement of sprinkler or sprinkler equivalent systems (2)                                                                                                                                                                                                                                   |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | A       | Fire-fighting equipment and firemen's outfits                                                                                                                                                                                                                                                  |
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | A       | Electrical diagram of the fixed gas fire-extinguishing systems, fixed fire detection systems, fire alarm and emergency lighting                                                                                                                                                                |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | A       | Electrical diagram of the sprinkler systems                                                                                                                                                                                                                                                    |
| 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | A       | Electrical diagram of power control and position indication circuits for fire devices                                                                                                                                                                                                          |
| 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | I       | General arrangement plan                                                                                                                                                                                                                                                                       |
| 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | I       | Safety zone plan                                                                                                                                                                                                                                                                               |
| 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | A       | Fire control plan                                                                                                                                                                                                                                                                              |
| <div><div>(1) A = to be submitted for approval, in four copies<br/>I = to be submitted for information, in duplicate.</div><div>(2) Plans are to be schematic and functional and to contain all information necessary for their correct interpretation and verification such as:<ul style="list-style-type: none"><li>• service pressures</li><li>• capacity and head of pumps and compressors, if any</li><li>• materials and dimensions of piping and associated fittings</li><li>• volumes of protected spaces, for gas and foam fire-extinguishing systems</li><li>• surface areas of protected zones for sprinkler and pressure water-spraying, low expansion foam and powder fire-extinguishing systems</li><li>• capacity, in volume and/or in mass, of vessels or bottles containing the extinguishing media or propelling gases, for gas, sprinkler, foam and powder fire-extinguishing systems</li><li>• type, number and location of nozzles of extinguishing media for gas, sprinkler, pressure water-spraying, foam and powder fire-extinguishing systems.</li></ul>All or part of the information may be provided, instead of on the above plans, in suitable operation manuals or in specifications of the systems.</div></div> |         |                                                                                                                                                                                                                                                                                                |

**2.1.3** When vulnerability zones are specified according to Pt C, Ch 4, Sec 1, [2.35], the bulkheads forming the boundaries of the vulnerability zones are to be in line with the safety zone bulkheads. A vulnerability zone may however include several safety zones.

**2.1.4** The bulkheads forming the boundaries of the safety zones shall be at least A-60 fire class divisions or equivalent. Where a category (5), (9) or (10) space defined in item b) of Pt C, Ch 4, Sec 5, [1.2.3] is on one side or where fuel or diesel oil or JP 5 NATO (F44) tanks or water capacity are on both sides of the division, the standard can be reduced to A-0.

**2.1.5** One damage control station is to be provided in each safety zone and equipped in such a way that the functionalities of the damage control station are also operable from an other one.

Note 1: The loss of one damage control station need not be considered for application of above requirement.

**2.1.6** At least one of the damage control station is to be permanently manned at sea.



Part D  
Service Notations

Chapter 2  
**AIRCRAFT CARRIER**

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|           |                          |
|-----------|--------------------------|
| SECTION 1 | GENERAL                  |
| SECTION 2 | HULL AND STABILITY       |
| SECTION 3 | MACHINERY AND SYSTEMS    |
| SECTION 4 | ELECTRICAL INSTALLATIONS |
| SECTION 5 | FIRE PROTECTION          |
| SECTION 6 | AIRCRAFT FACILITIES      |



SECTION 1

GENERAL

1 General

1.1 Application

1.1.1 Ships complying with the requirements of this Chapter are eligible for the assignment of the service notation **Aircraft carrier**, as defined in Pt A, Ch 1, Sec 2, [4.3.1].

1.2 Summary table

1.2.1 The Sections of this Chapter containing additional requirements for **Aircraft carrier** ships are indicated in Tab 1.

Table 1 :

| Main subject                                                                              | Reference   |
|-------------------------------------------------------------------------------------------|-------------|
| Ship arrangement                                                                          | (1)         |
| Hull and stability                                                                        | Ch 2, Sec 2 |
| Machinery and systems                                                                     | Ch 2, Sec 3 |
| Electrical installations                                                                  | Ch 2, Sec 4 |
| Fire protection                                                                           | Ch 2, Sec 5 |
| Aircraft facilities                                                                       | Ch 2, Sec 6 |
| (1) The Rules do not contain specific requirements for aircraft carriers on this subject. |             |

2 Definition

2.1 General

2.1.1 Aircrafts

Aircrafts for this Chapter are to be understood as airplanes or helicopters or Unmanned Combat Airplane Vehicles (UCAV).

2.1.2 Flight deck

The flight deck is the uppermost continuous platform deck used for aircraft operations, extending from fore end to aft end and from starboard to portside.

2.1.3 Sponsons

Sponsons are the structural constructions added either side of side shell, and located just at side of the flight deck.

2.1.4 External platforms

External platforms are the small structural constructions added either side of side shell.

2.2 Aircraft operation

2.2.1 Aircraft facilities

Aircraft facilities are systems and equipments which purpose are only to allow the flight, the internal movements, the supplying, the maintenance and the repair of the aircrafts aboard the aircraft carrier in order to ensure the mission.

As a general arrangement most of these facilities are organized on a flight deck with an island and a hangar deck.

3 Subdivision arrangement

3.1 After peak, machinery space bulkheads and stern tubes

3.1.1 General

An after peak bulkhead, and bulkheads dividing the machinery space from the cargo and personnel spaces forward and aft, are also to be fitted and made watertight up to the watertight deck. The after peak bulkhead may be stepped, provided the degree of safety of the ship as regards subdivision is not thereby diminished.

3.2 Doors

3.2.1 Doors in cargo spaces

*The doors accessible during the voyage, are to be fitted with a device which prevents unauthorized opening.*

*Additionally, indicators are required on the safety control station to show automatically when each door is closed and all door fastenings are secured.*

3.2.2 Doors or ramps in large cargo spaces

*Such doors are to be closed before the voyage commences and are to be kept closed during navigation. Should any of the doors or ramps be accessible during the voyage, they are to be fitted with a device which prevents unauthorized opening.*

4 Compartment arrangement

4.1 Fuel oil tanks

4.1.1 Where a compartment intended for goods or coal is situated in proximity of a heated liquid container, suitable thermal insulation is to be provided.

## SECTION 2 HULL AND STABILITY

### 1 Stability

#### 1.1 Intact stability

##### 1.1.1 Calculation of the GZ curves

For the purpose of calculating the righting lever curves GZ, the external platforms located along the side shell below the flight deck, should not be considered as buoyant spaces.

However, it may be accepted to consider the "bulges" as buoyant spaces, provided their structural design is strong enough to sustain the Rules sea loads.

#### 1.2 Damage stability

##### 1.2.1 Permeability of cargo spaces

The permeability for cargo spaces intended for the stowage of land vehicles, barges, helicopters and containers is to be derived by calculation in which the land vehicles, barges, helicopters and containers are to be assumed as non-water-tight and their permeability equal to 0,65.

In no case is the permeability of cargo spaces in which the goods, vehicles and containers are carried to be taken less than 0,60.

### 2 Structure design principles

#### 2.1 General information

##### 2.1.1 Aircrafts

The types of aircraft for which the aircraft carrier is designed are to be formally given as a list.

Particularly, this list must clearly indicate:

- the types of aircraft allowed to land and take-off (structure design of flight deck)
- the types of aircraft for which maintenance on board is considered (structure design of aircraft elevators and hangar deck).

For each aircraft, the following data are to be indicated:

- the number of axles and the relative arrangement of axles
- the number of wheels per axle and their relative arrangement
- the maximum mass of the aircraft, for each operational case (landing, catapulting, parking)
- the maximum load, in kN, per wheel, and the corresponding tyre print for each operational case (parking, normal landing, hard and emergency landing, take-off). It is accepted to consider that the load per tyre and the corresponding tyre print are proportional.

Where helicopters are considered, the requirements of Pt B, Ch 8, Sec 10 are also to be complied with.

##### 2.1.2 Tractors and mobile cranes

The types of engined tractors intended to be used on flight deck, elevators and hangar deck are to be formally specified.

The following data are to be indicated:

- the number of axles and the relative arrangement of axles
- the maximum load per axle
- the number of wheels per axle and their relative arrangement.

Any movable crane used on flight deck (for removal of crashed aircraft or other operations) is also to be formally specified, with respect to its operational use and Safe Working Load.

##### 2.1.3 Lifting devices for maintenance

All eye plates permanently fitted in decks and used for lifting operations during maintenance are to comply with Pt B, Ch 9, Sec 5.

The Safe Working Load of each eye plate permanently fitted in decks is to be indicated on drawings.

Moreover, each lifting eye is to be fitted with information about SWL and load testing.

Load test are to be performed periodically, with a load test equal to 125% of SWL.

#### 2.2 Flight deck

##### 2.2.1 Description of zones

The partitioning of the flight deck into various zones considered for design is to be formally documented with respect to their functional use at sea (parking / normal landing / emergency loading / take-off). This information is also to include the type, number and arrangement of aircraft in each zone.

Where one area of the flight deck is concerned by several functional uses, the scantlings are to be checked for all possible loads.

##### 2.2.2 Coating of flight deck

Any possible coating or sheating on flight deck is to indicated and described. Its protective index is to be given, with respect to mechanical shocks and sea water corrosion.

##### 2.2.3 Emergency landing zone

If any, the emergency landing zone is to be clearly specified, together with relevant design criteria.

##### 2.2.4 Structure in way of catapults and arresters

The exact locations of catapults and arresters are to be indicated.

### 2.2.5 Flight deck openings

The various openings in flight deck are to be clearly defined with respect to their location and size (Ammunition elevators, jet stream deflectors, aviation cabins for flight officer, etc.).

Particularly, the transverse and longitudinal extent of the flight deck recesses are to be clearly marked on relevant structure drawings.

### 2.2.6 Aircraft lashing devices

The lashing devices fitted in the flight deck are to be clearly shown on structure drawings.

Their design is to be submitted, with information about their Safe Working Load (SWL) and the detail of their fitting into the flight deck.

## 2.3 Hangar

### 2.3.1 General

General information about hangar are to be submitted, particularly regarding the open or closed situation with respect to wave loads.

### 2.3.2 Description of zones

Various zones of hangar deck considered during design are to be documented, with respect to their functional use at sea (maintenance of aircraft, cargo area, etc.).

In particular, the design loads on the various structural mezzanines in the hangar are to be specified.

### 2.3.3 Doors in side shell in way of aircraft elevators

The doors on side shell in way of aircraft elevators are to be weathertight.

They are to comply with Pt B, Ch 8, Sec 6.

### 2.3.4 Fire doors partitioning the hangar

As a rule, the fire doors partitioning the hangar, if any, are considered as non structural items, except if otherwise mentioned.

### 2.3.5 Hangar deck openings

The various openings in hangar deck are to be clearly defined with respect to their location and size.

In particular, any deck recess in way of hangar fire doors is to be detailed, if relevant.

### 2.3.6 Aircraft lashing devices

The lashing devices fitted in the hangar deck are to be clearly shown on structure drawings.

Their design is to be submitted, with information about their Safe Working Load (SWL) and the detail of their fitting into the deck.

## 2.4 Sponsons

### 2.4.1 Undersides

The underside of sponsons is the inclined lowest boundary surface, with transverse limits as follows:

- inside limit: vessel side shell
- outside limit: hard chine of sponson at side, if any, or point where tangent to surface shows a 60° angle with respect to horizontal plane, in case of rounded bilge.

## 2.5 Fixed cranes on deck

**2.5.1** Any fixed crane fitted on flight deck is to be clearly specified, with respect to its operational use and Safe Working Load.

## 2.6 Aircraft elevators

### 2.6.1 General

General information about aircraft elevators location and type (i.e. internal or deck edge) are to be submitted, particularly regarding the possibility for the underside of the elevators platform to sustain wave loads.

### 2.6.2 Lifting operations

Lifting operations are to be described, with detailed information about Safe Working Load of elevators, type of loads carried out and operating procedures with corresponding load dynamic amplification factors.

Dynamic amplification factors include combined effects of:

- a) vertical acceleration induced by start and stop of lifting process
- b) accelerations induced by behaviour of ship at sea.

When a ship motion damping system is fitted, it may be accepted, on a case by case basis, to reduce the accelerations mentioned in item b) above. The reduction level, if any, will be defined after an analysis of operating procedures in normal conditions and in degraded conditions.

### 2.6.3 Securing devices

If any, securing devices are to be specified, with information about their design and operating.

## 2.7 Ammunitions elevators

### 2.7.1 Lifting operations

Lifting operations are to be described, with detailed information about Safe Working load of elevators, type of loads carried out and operating procedures with corresponding load dynamic amplification factors.

Dynamic amplification factors include combined effects of:

- a) vertical acceleration induced by start and stop of lifting process
- b) accelerations induced by behaviour of ship at sea.

When a ship motion damping system is fitted, it may be accepted, on a case by case basis, to reduce the accelerations mentioned in b) above. The reduction level, if any, will be defined after an analysis of operating procedures in normal conditions and in degraded conditions.

3 Design loads

3.1 Local loads on flight deck

3.1.1 General

Loads to be considered on flight deck are sea pressure and aircraft loads. Above types of loads can be considered separately.

3.1.2 Sea pressure

Sea pressure is to be taken according to Pt B, Ch 5, Sec 5, [1.2].

As a Rule,  $\phi$  can be considered as 0,75.

3.1.3 Wheeled loads

The design wheeled loads to be considered for the assessment of the flight deck structure are to cover all types of tyred vehicles operating on the flight deck (aircraft, tractors, mobile cranes, etc.), in all possible operating conditions.

The wheeled loads are to be indicated by the designer:

- for aircrafts: according to [2.1.1]
- for tractors and mobile cranes: according to [2.1.2].

Design pressures for aircrafts during landing and catapulting operation are to be taken according to Tab 1, for each aircraft and each possible operating mass. Maximum vertical forces are to be considered per wheel or group of wheels loading the structural member under consideration.

Design pressures for aircrafts during parking operations and for tractors and mobile cranes are to be taken according to Pt B, Ch 5, Sec 6, [4].

3.2 Local loads on hangar deck and mezzanines

3.2.1 Cargo loads

The design cargo loads on the hangar deck are to be taken in accordance with Pt B, Ch 5, Sec 6, [2] and Pt B, Ch 5, Sec 6, [3].

The design cargo loads on the various structural mezzanines in the hangar are to be taken according to Pt B, Ch 5, Sec 6, [2] and Pt B, Ch 5, Sec 6, [3]. In specific areas used only as companionway, the minimum still water pressure  $p_s$ , in kN/m<sup>2</sup>, to be considered in Pt B, Ch 5, Sec 6, Tab 3 is to be taken equal to  $p_s = 5$ .

3.2.2 Wheeled loads

The design wheeled loads to be considered for the assessment of the hangar deck are to cover all types of tyred vehicles used during maintenance of aircraft.

The wheeled loads are to be indicated by the designer:

- for aircrafts: according to [2.1.1] (parking condition)
- for tractors and mobile cranes: according to [2.1.2].

Design pressures are to be taken according to Pt B, Ch 5, Sec 6, [4].

3.2.3 Sea loads

When wave loads are expected, the design pressure to be considered for Rules checking will be defined on a case by case basis.

3.3 Local loads on island and bridge

3.3.1 Loads on front, aft and side walls of island and bridge are to be calculated according to Pt B, Ch 8, Sec 4. For this application, it is accepted that the lowest tier of the island be considered as a second tier.

Loads on decks of island and bridge are calculated according to Pt B, Ch 8, Sec 4.

3.4 Local loads on sponsons

3.4.1 Sideshell of sponsons

Load heights on sides of sponsons are to be taken according to Pt B, Ch 5, Sec 5, Tab 3 for upright ship conditions and Pt B, Ch 5, Sec 5, Tab 5 for inclined ship conditions.

For inclined ship conditions, the roll amplitude  $A_R$  is to be calculated according to Pt B, Ch 5, Sec 3, without any consideration given to the motion damping system, if any.

3.4.2 Front wall and aft wall of sponsons

Load heights on front wall of sponsons are to be taken according to Pt B, Ch 5, Sec 5, Tab 3 for upright ship conditions and Pt B, Ch 5, Sec 5, Tab 5 for inclined ship conditions.

For inclined ship conditions, the roll amplitude  $A_R$  is to be calculated according to Pt B, Ch 5, Sec 3, without any consideration given to the motion damping system, if any.

Table 1 : Design pressures for aircrafts

| Operation                                                                                                                                              | Mass of aircraft (t) | Main undercarriage          |                              |                           | Fore under carriage         |                              |                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------------------------|------------------------------|---------------------------|-----------------------------|------------------------------|---------------------------|
|                                                                                                                                                        |                      | Maximum vertical force (kN) | Still water force $F_s$ (kN) | Inertial force $F_w$ (kN) | Maximum vertical force (kN) | Still water force $F_s$ (kN) | Inertial force $F_w$ (kN) |
| Landing - Normal                                                                                                                                       | $M_1$                | $F_{MN}$                    | 0                            | $F_{MN}$                  | $F_{FN}$                    | 0                            | $F_{FN}$                  |
| Landing - Hard                                                                                                                                         | $M_1$                | $F_{MH}$                    | 0                            | $F_{MH}$                  | $F_{FH}$                    | 0                            | $F_{FH}$                  |
| Landing - Exceptional                                                                                                                                  | $M_1$                | $F_{ME}$                    | 0                            | $F_{ME}$                  | $F_{FE}$                    | 0                            | $F_{FE}$                  |
| Catapulting                                                                                                                                            | $M_2$                | $F_{MC}$                    | $M g$ (1)                    | $F_{MC} - M g$            | NA                          | NA                           | NA                        |
| (1) $M$ is to be calculated as follows: $M = Q_A / n_w$<br>where $Q_A$ is the axle load, in t, and $n_w$ the number of wheels for the axle considered. |                      |                             |                              |                           |                             |                              |                           |

### 3.4.3 Underside of sponsons

For transverse sections located longitudinally such that  $x/L$  is less than 0,7, the sea pressure to be considered is the normal sea pressure acting on side shell.

For transverse sections located longitudinally such that  $x/L$  is greater than or equal to 0,7, the sea impact pressure on sponsons  $p_{FI}$  is to be obtained, in  $\text{kN/m}^2$ , from the following formula:

$$p_{FI} = C_S C_Z (0,22 + 0,15 \tan \alpha) (0,4V \sin \beta + 0,6\sqrt{L})^2$$

where:

$C_S$  : Coefficient depending on the type of structures on which the impact pressure is considered to be acting:

- $C_S = 1,8$  for plating and ordinary stiffeners
- $C_S = 0,5$  for primary supporting members

$C_Z$  : Coefficient depending on the distance between the full load waterline and the calculation point:

- for  $z \geq 2 C + T - 11$ :  $C_Z = C - 0,5 (z - T)$
- for  $z < 2 C + T - 11$ :  $C_Z = 5,5$

$C$  : Wave parameter:

$$C = 10,75 - \left( \frac{300 - L}{100} \right)^{1,5} \text{ for } 90 \text{ m} \leq L < 300 \text{ m}$$

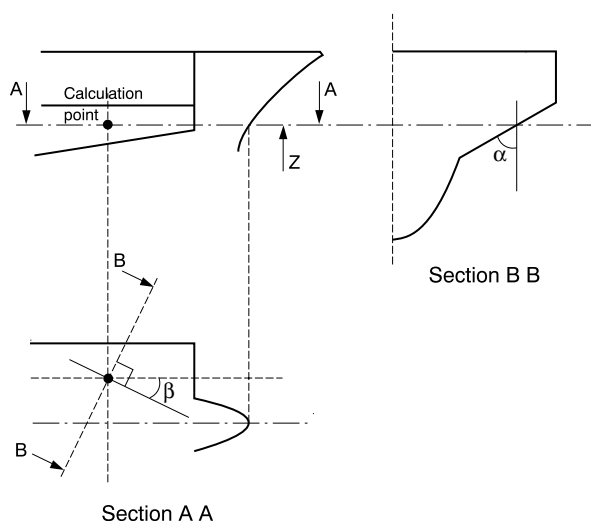
$$C = 10,75 \text{ for } 300 \text{ m} \leq L \leq 350 \text{ m}$$

$$C = 10,75 - \left( \frac{L - 350}{150} \right)^{1,5} \text{ for } L > 350 \text{ m}$$

$\alpha$  : Flare angle at the calculation point, defined as the angle between a vertical line and the tangent to the underside plating, measured in a vertical plane normal to the horizontal tangent to the shell plating (see Fig 1)

$\beta$  : Entry angle at the calculation point, defined as the angle between a longitudinal line parallel to the centreline and the tangent to the shell plating in a horizontal plane (see Fig 1).

Figure 1 : Definition of angles  $\alpha$  and  $\beta$



## 3.5 Loads on aircraft elevators

### 3.5.1 Cargo loads

When aircraft elevators are not exposed to sea loads, the design pressure exerted on the platform of the aircraft elevators are to be taken in accordance with Pt B, Ch 5, Sec 6, [2] and Pt B, Ch 5, Sec 6, [3].

When aircraft elevators are exposed to sea loads, the design pressure exerted on the platform of the aircraft elevators is to be taken in accordance with Pt B, Ch 5, Sec 5.

In this case, the wave impact pressure on the underside of the platform, in lower position, will be defined on a case by case basis.

### 3.5.2 Wheeled loads

The wheeled loads on the aircraft elevator platform exerted by aircrafts subject to maintenance are to be taken in accordance with [2.1.1] for parking situation.

The wheeled loads on the aircraft elevator platform exerted by tractors are to be taken in accordance with [2.1.2] for parking situation.

Dynamic amplification factors according to [2.6.2] are also to be considered.

## 3.6 Loads on ammunition elevators

### 3.6.1 Cargo loads

The design pressure exerted on the platform of the ammunition elevators are to be taken in accordance with Pt B, Ch 5, Sec 6, [2] and Pt B, Ch 5, Sec 6, [3].

## 4 Hull girder strength

### 4.1 Strength characteristics of the hull girder transverse sections

#### 4.1.1 Contribution of flight deck

The flight deck is generally to be considered as the strength deck.

The actual contribution of flight deck in way of sponsons is to be confirmed by FEM analysis.

The openings in the flight deck (aircraft elevators, other elevators, ammunition elevators, jet stream deflector, catapults recesses, aviation cabins for flight officer) are to be taken into consideration in accordance with relevant requirements of Pt B, Ch 4, Sec 6, [6] and Pt B, Ch 6, Sec 1, [2].

#### 4.1.2 Contribution of sponsons

The actual contribution of the sponsons is to be confirmed by FEM analysis.

#### 4.1.3 Openings in side shell and sponsons

The openings in side shell deck and sponsons (hanger doors, other doors) are to be taken into consideration in accordance with relevant requirements of Pt B, Ch 6, Sec 1, [2].

Table 2 : Plating of flight deck - Partial safety factors

| Partial safety factors covering uncertainties regarding | Symbol        | Sea pressure | Landing Normal | Landing Hard | Landing Emergency | Catapulting | Parking |
|---------------------------------------------------------|---------------|--------------|----------------|--------------|-------------------|-------------|---------|
| Still water hull girder loads                           | $\gamma_{S1}$ | 1,00         | 0              | 0            | 0                 | 0           | 1,00    |
| Wave hull girder loads                                  | $\gamma_{W1}$ | 1,15         | 0              | 0            | 0                 | 0           | 1,15    |
| Still water pressure                                    | $\gamma_{S2}$ | 1,00         | 1,00           | 1,00         | 1,00              | 1,00        | 1,00    |
| Wave pressure                                           | $\gamma_{W2}$ | 1,20         | 1,20           | 1,20         | 1,05              | 1,20        | 1,20    |
| Material                                                | $\gamma_m$    | 1,02         | 1,02           | 1,02         | 1,02              | 1,02        | 1,02    |
| Resistance                                              | $\gamma_R$    | 1,20         | 1,20           | 1,20         | 1,20              | 1,20        | 1,20    |

Table 3 : Stiffeners of flight deck - Partial safety factors

| Partial safety factors covering uncertainties regarding | Symbol        | Sea pressure | Landing Normal | Landing Hard | Landing Emergency | Catapulting | Parking |
|---------------------------------------------------------|---------------|--------------|----------------|--------------|-------------------|-------------|---------|
| Still water hull girder loads                           | $\gamma_{S1}$ | 1,00         | 0              | 0            | 0                 | 0           | 1,00    |
| Wave hull girder loads                                  | $\gamma_{W1}$ | 1,15         | 0              | 0            | 0                 | 0           | 1,15    |
| Still water pressure                                    | $\gamma_{S2}$ | 1,00         | 1,00           | 1,00         | 1,00              | 1,00        | 1,00    |
| Wave pressure                                           | $\gamma_{W2}$ | 1,20         | 1,20           | 1,20         | 1,05              | 1,20        | 1,20    |
| Material                                                | $\gamma_m$    | 1,02         | 1,02           | 1,02         | 1,02              | 1,02        | 1,02    |
| Resistance                                              | $\gamma_R$    | 1,20         | 1,02           | 1,02         | 1,02              | 1,02        | 1,02    |

4.2 Yielding check

4.2.1 Torque wave bending moment

Wave torque as specified in Pt B, Ch 6, Sec 2 is to be considered.

4.2.2 Structural model for the calculation of shear stresses

FEM analysis or thin walled beam models representing members which constitute the hull girder transverse sections may be used for calculation of vertical shear stress distribution.

5 Hull scantlings of flight deck

5.1 General

5.1.1 Structural singularities

The scantlings of flight deck local reinforcement in way of structural singularities (arresters, catapults, deflectors hinges etc.) are to be assessed on first principle basis.

Design forces (amplitudes, directions) and associated safety coefficients are to be agreed upon on a case by case basis.

5.2 Plating

5.2.1 The scantlings of the plating of flight deck under wheeled loads and sea pressure are to be in compliance with requirements of Pt B, Ch 7, Sec 1 with partial safety factors according to Tab 2.

5.3 Ordinary stiffeners

5.3.1 The scantlings of the ordinary stiffeners of flight deck under wheeled loads and sea pressure are to be in compliance with requirements of Pt B, Ch 7, Sec 2, with partial safety factors according to Tab 3.

5.4 Primary supporting structure

5.4.1 The scantlings of the primary structure of flight deck under wheeled loads and sea pressure are to be in compliance with requirements of Pt B, Ch 7, Sec 3, with partial safety factors according to Tab 3.

6 Sponsons

6.1 Side shell

6.1.1 Plating, ordinary stiffeners and primary structure

The scantlings of side shell of sponsons are to be in accordance with Part B, Chapter 7, with loads according to [3.4]. When sponsons are not contributing to hull girder strength, the scantlings are to be checked according to Part B, Chapter 7, with loads according to [3.4] and with longitudinal stress  $\sigma_l$  equal to 0.

6.2 Front wall and aft wall

6.2.1 Plating, ordinary stiffeners and primary structure

The scantlings of front wall and aft wall of sponsons are to be in accordance with Part B, Chapter 7, with loads according to [3.4], and with longitudinal stress  $\sigma_l$  equal to 0.

6.3 Underside

6.3.1 Partial safety factors

For transverse sections located longitudinally such than  $x/L$  is less than 0,7, the partial safety factors to be considered are given in Pt B, Ch 7, Sec 1, Pt B, Ch 7, Sec 2 or Pt B, Ch 7, Sec 3, as applicable.

For transverse sections located longitudinally such than  $x/L$  is greater than or equal to 0,7, the partial safety factors to be considered are to be taken as follows:

- Tab 4 for plating and ordinary stiffeners of the underside of sponsons
- Pt B, Ch 7, Sec 3 for primary structure of the underside of sponsons.

Table 4 : Reinforcements of the underside of sponsons  
Partial safety factors

| Partial safety factors covering uncertainties regarding: | Partial safety factors |         |                     |
|----------------------------------------------------------|------------------------|---------|---------------------|
|                                                          | Symbol                 | Plating | Ordinary stiffeners |
| Still water pressure                                     | $\gamma_{s2}$          | 1,00    | 1,00                |
| Wave pressure                                            | $\gamma_{w2}$          | 1,10    | 1,10                |
| Material                                                 | $\gamma_m$             | 1,02    | 1,02                |
| Resistance                                               | $\gamma_R$             | 1,30    | 1,02                |

6.3.2 Plating and ordinary stiffeners

For transverse sections located longitudinally such than  $x/L$  is less than 0,7, the net scantlings of plating and ordinary stiffeners of the underside of cantilever quarters below flight deck are to be checked according to Pt B, Ch 7, Sec 1 or Pt B, Ch 7, Sec 2, as applicable. However, the net scantlings of plating and ordinary stiffeners are to be not less than the minimum values given in Tab 5.

For transverse sections located longitudinally such than  $x/L$  is greater than or equal to 0,7, the net scantlings of plating and ordinary stiffeners of the underside of cantilever quar-

ters below flight deck are to be not less than the values obtained from the formulae in Tab 5 and the minimum values in the same Table.

6.3.3 Intercostal stiffeners

Intercostal stiffeners are to be fitted at mid-span where the angle between the stiffener web and the attached plating is less than 70°.

6.3.4 Primary supporting members

Primary supporting members are generally to be verified through direct calculations carried out according to Pt B, Ch 7, Sec 3, considering the sea impact pressures defined in [3.4.1].

6.3.5 Strengthening of sponsons underside in way of workboats / lifeboats

Stiffening of undersides of cantilever quarters in way of workboats / lifeboats is to be compatible with the launching operation. Cantilever quarters in way of launching appliances are to be adequately strengthened.

7 Other hull scantlings

7.1 Bottom

7.1.1 Bottom plating

The minimum net thickness of bottom plating is to be not less than the values given in Tab 6.

7.2 Hangar

7.2.1 Hangar deck

The scantlings of the hangar deck structure and the mezzanine decks in the hangar under wheeled loads and cargo loads are to be in compliance with requirements of Part B, Chapter 7.

Table 5 : Reinforcements of plating and ordinary stiffeners of the underside of sponsons

| Element                                                                                                                                                                                                                             | Formula                                                                                                                                                           | Minimum value                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Plating                                                                                                                                                                                                                             | Net thickness, in mm:<br>$t = 11 C_a C_r S \sqrt{\gamma_R \gamma_m \frac{\gamma_{W2} P_{FI}}{R_y}}$                                                               | Net minimum thickness, in mm:<br>$t = (0,03 L + 5,5) k^{1/2}$                                                                                                                                                  |
| Ordinary stiffeners                                                                                                                                                                                                                 | Net section modulus, in cm <sup>3</sup> :<br>$w = \gamma_R \gamma_m \beta_b \frac{\gamma_{W2} P_{FI}}{18 C_p R_y} \left(1 - \frac{s}{2\ell}\right) s \ell^2 10^3$ | Web net minimum thickness, in mm, to be not less than the lesser of: <ul style="list-style-type: none"><li>• <math>t = 1,5 L_2^{1/3} k^{1/6}</math></li><li>• the thickness of the attached plating.</li></ul> |
|                                                                                                                                                                                                                                     | Net shear sectional area, in cm <sup>2</sup> :<br>$A_{Sh} = 10 \gamma_R \gamma_m \beta_s \frac{\gamma_{W2} P_{FI}}{R_y} \left(1 - \frac{s}{2\ell}\right) s \ell$  |                                                                                                                                                                                                                |
| <b>Note 1:</b><br>C <sub>p</sub> : Ratio of the plastic section modulus to the elastic section modulus of the ordinary stiffeners with attached shell plating, to be taken equal to 1,16 in the absence of more precise evaluation. |                                                                                                                                                                   |                                                                                                                                                                                                                |

Table 6 : Minimum net thickness of bottom plating

| Plating              | Minimum net thickness (mm)      |
|----------------------|---------------------------------|
| Longitudinal framing | $2,8 + 0,032 L k^{1/2} + 4,5 s$ |
| Transverse framing   | $3,8 + 0,032 L k^{1/2} + 4,5 s$ |

7.2.2 Transverse racking effect

The transverse partial bulkheading structure in the hangar is to be checked against transverse racking effect induced by transverse accelerations exerted on deck structure between hangar and flight deck.

The most severe conditions are to be considered for loads and transverse accelerations.

Stress criteria are given in Pt B, Ch 7, Sec 3, [2].

7.3 Island and bridge

7.3.1 The scantlings of island and bridge are to be in accordance with Pt B, Ch 8, Sec 4, applicable to deckhouses.

Special consideration is to be given to support of masts and aerals at top of island. Strength continuity downwards through several decks may be requested.

7.4 Aircraft elevators

7.4.1 Plating

The scantlings of the plating of aircraft elevators under wheeled loads are to be in compliance with requirements of Pt B, Ch 7, Sec 1.

7.4.2 Ordinary stiffeners

The scantlings of the ordinary stiffeners of aircraft elevators under wheeled loads are to be in compliance with requirements of Pt B, Ch 7, Sec 2.

7.4.3 Primary structure

The scantlings of the primary structure of aircraft elevators under wheeled loads are generally to be checked on basis of three dimensional structural model, according to the requirements of Pt B, Ch 7, Sec 3, [2] and Pt B, Ch 7, Sec 3, [5].

7.4.4 Locking and lifting devices

The scantlings of locking and lifting devices and the surrounding reinforcements are to be assessed on first principle basis.

Design forces (amplitudes, directions) and associated safety coefficients are to be agreed upon on a case by case basis.

7.5 Ammunition elevators

7.5.1 Plating

The scantlings of the plating of ammunition elevators loads are to be in compliance with requirements of Pt B, Ch 7, Sec 1.

7.5.2 Ordinary stiffeners

The scantlings of the ordinary stiffeners of ammunition elevators are to be in compliance with requirements of Pt B, Ch 7, Sec 2.

7.5.3 Primary structure

The scantlings of the primary structure of ammunitions elevators are generally to be checked on basis of three dimensional structural model, according to the requirements of Pt B, Ch 7, Sec 3, [2] and Pt B, Ch 7, Sec 3, [5].

7.5.4 Locking and lifting devices

The scantlings of locking and lifting devices and the surrounding reinforcements are to be assessed on first principle basis.

Design forces (amplitudes, directions) and associated safety coefficients are to be agreed upon on a case by case basis.

8 Hull outfitting

8.1 Anchoring equipment

8.1.1 The anchoring equipment is to be determined according to Pt B, Ch 9, Sec 4.

The equipment number EN is to be obtained according to Pt B, Ch 9, Sec 4, [2.1], where (2 h B) is to be replaced by:  $(2 h B + A_{CQST} + A_{CQPS})$ ,

with:

$A_{CQST}$  : Projected front area of starboard cantilever quarters below flight deck, located outside vertical longitudinal plane tangent to waterline

$A_{CQPS}$  : Projected front area of portside cantilever quarters below flight deck, located outside vertical longitudinal plane tangent to waterline.

8.2 Towing arrangement

8.2.1 The towing operations are not covered by the Classification.

9 Fatigue analysis

9.1 Structural details

9.1.1 The details to be checked against fatigue, according to Pt B, Ch 7, Sec 4, are to be defined jointly with the Designer, at the beginning of the Classification design review process.

## SECTION 3

## MACHINERY AND SYSTEMS

### 1 General

#### 1.1 Application

**1.1.1** Ships having the service notation **Aircraft carrier** are to comply with the general requirements of Part C, Chapter 1. In addition they have to comply with the provisions of this Section.

### 2 Main propulsion

#### 2.1 Availability

**2.1.1** When in flight operation and especially in aircraft recovery phase the ordered speed of the ship is to be kept to avoid variation of the relative wind on the flight deck outside of the allowed range and a special consideration will be given to the general arrangement of the main propulsion.

Therefore the main propulsion system is to comply at least with the requirements of the additional class notation **AVM-DPS** for duplicated propulsion and steering systems as defined in Pt E, Ch 3, Sec 2.

### 3 Steering system

#### 3.1 Availability

**3.1.1** When in flight operation and especially in aircraft recovery phase the ordered course of the ship is to be kept to avoid variation of the relative wind on the flight deck so the steering gear is to fulfil the requirements of duplicated propulsion and steering systems **AVM-DPS** as per Pt E, Ch 3, Sec 2.

Where steering gear is used as a component of the stabilization system a special attention is to be paid on the life reduction due to this use.

### 4 Stabilization system

#### 4.1 General

**4.1.1** Where ship movements exceed the maximum allowed for safety of the aircraft operation the ship could be equipped with systems to reduce the movements within the allowed range with the environmental conditions requested by the Naval Authority.

Where system for reducing the movements is installed, this system is to be considered as a secondary essential service in complement of Pt C, Ch 2, Sec 1, [3.4.1].

#### 4.1.2 Stabilization equipment

Where stabilization system is based on fin type roll stabilizers, these equipment are to comply with the general requirements for steering gear as per Pt C, Ch 1, Sec 11.

### 5 Heel correction system

#### 5.1 General

**5.1.1** Where angle of heel due to ship evolution or to aircraft transfer on flight deck or on hanger deck exceed the maximum allowed angle for safety of the aircraft operation the ship could be equipped with systems to reduce this angle of heel within the allowed range with the environmental conditions requested by the Naval Authority.

Where system for reducing this heel is installed, this system is to be considered as a secondary essential service in complement of Pt C, Ch 2, Sec 1, [3.4.1].

### 6 Aircraft launching

#### 6.1 Take off facilities

##### 6.1.1 General

Where catapult launching is needed, take off facilities include:

- steam catapult installation
- jet deflector
- sling recovery device (if any).

The steam catapult installation is to be considered as a secondary essential service in complement of Pt C, Ch 2, Sec 1, [3.4.1].

##### 6.1.2 Steam catapult

Catapults for aircraft carrier are generally steam catapults.

The catapult itself is composed with:

- the cylinder
- the piston
- the piston arrester
- the putting back in battery system
- the inlet regulating steam valve.

These equipment are out of the scope of the class.

##### 6.1.3 Catapult steam installation

The steam accumulator and the steam generator are to comply with requirements of Pt C, Ch 1, Sec 3.

A special attention is to be paid to the fatigue thermal cycling of these boilers and pressure vessel and of the associate piping.

The feed water production installation is to be design taking in account the intended consumption of water due to the catapult launching. In particular the increase of salinity of the steam generator is to be avoided.

#### 6.1.4 Jet deflector

Jet deflector screen are installed to protect the flight deck staff from hot gazes blast during launching operation. This equipment is to comply with general requirements of Pt C, Ch 1, Sec 3 and Pt C, Ch 1, Sec 10.

## 7 Aircraft recovery

### 7.1 Landing facilities

#### 7.1.1 General

The aircraft landing facilities may include:

- arresting gear installation
- landing path guidance:
  - landing area deck lights
  - optical landing system
- aircraft barricade.

The arresting gear installation, the landing area deck lights and the optical landing system are to be considered as a secondary essential service in complement of Pt C, Ch 2, Sec 1, [3.4.1].

#### 7.1.2 Arresting gear installation

Arresting gear installation are mainly composed of 3 or 4 independent arresting cables with their own pulleys and hydraulic cylinders.

The components are to comply with general requirement of Pt C, Ch 1, Sec 3 and Pt C, Ch 1, Sec 10.

In case of malfunction of one of these arresting cable, disposition as to be taken in order to clear the landing area of the defective cable within a delay acceptable by the aircraft recovery operation.

## 8 Aircraft handling

### 8.1 Internal movements

#### 8.1.1 General

The movements of the aircraft between the flight deck and the hangar deck are operated by aircraft elevators.

The movements of the aircraft on a deck are operated with tractors.

Deck crane is also to be provided for handling of a crashed aircraft.

The aircraft elevators are to be considered as a secondary essential service in complement of Pt C, Ch 2, Sec 1, [3.4.1].

#### 8.1.2 Aircraft elevators

Aircraft elevators are to comply with general requirements of Pt B, Ch 8, Sec 8, and with requirements of NR 526 Rules for Cranes, as far as they are applicable to unmanned plat-

form elevator. The following requirements are also to be complied with:

- a mechanical locking of the platform at the two levels hangar deck and flight deck is to be provided
- disposition are to be taken to avoid any change in the level of the platform when removing the locking whatever load change occurred
- platforms are to be equipped to ensure security of staff and load against falling
- platforms are to be equipped to avoid any contact of staff or load with fixed parts of ship during movements of the platforms
- hangar deck and flight deck are to be equipped with disposal to avoid any fall of staff or load when platform is not locked at the deck level.

#### 8.1.3 Deck crane

Deck crane for security purpose is to be provided for emergency lifting of aircraft in any area of the flight deck. This crane could be of a mobile type.

This crane is to comply with general requirements of NR 526 Rules for Cranes.

## 9 Aircraft supplying

### 9.1 General

9.1.1 The supply of the aircraft needs among others handling, storage or production for:

- fuel
- ammunition
- oxygen for breathing purpose
- special ingredients and fluids for aircraft
- aircraft electric power.

#### 9.1.2 Refuelling system

Refuelling system is to comply with requirements for helicopter platform as per Pt C, Ch 1, Sec 10, [11] and Pt C, Ch 4, Sec 10, [4].

#### 9.1.3 Weapons elevators

Weapons elevators are to comply with general requirements as per BV Rules and with requirements of NI 184, as far as they are applicable to unmanned platform elevator.

#### 9.1.4 Oxygen production and storage

A special consideration for risk of high concentration of oxygen is to be taken into account for aircraft breathing oxygen storage and production installation. Whenever liquefied oxygen is present on board, special consideration for consequences of leakage is to be taken into account. These consequences are to include fire risk and damage to ship structures.

## SECTION 4

## ELECTRICAL INSTALLATIONS

### 1 General

#### 1.1 Applicability

**1.1.1** In addition to the requirements given in Part C, Chapter 2 and Part C, Chapter 3, the following requirements are applicable for aircraft carriers.

#### 1.2 Documentation to be submitted

**1.2.1** In addition to the documents requested in Pt C, Ch 2, Sec 1, the following documents are to be submitted for information:

- harmonic analysis
- stability study of network.

### 2 Design of electrical installation

#### 2.1 Harmonic distortions

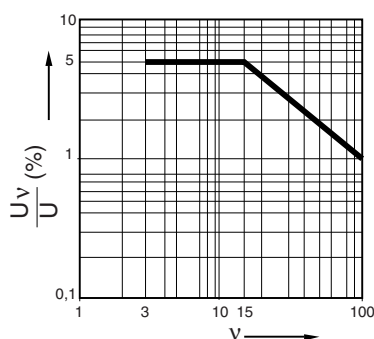
**2.1.1** The following requirements are to replace the requirements of Pt C, Ch 2, Sec 2, [2.4].

**2.1.2** For electrical systems intended for systems without substantially static converter loads and supplied by synchronous generators, it is assumed that the total voltage harmonic distortion does not exceed 5%, and the single harmonic does not exceed 3% of the nominal voltage.

**2.1.3** For electrical systems fed by a network supplied by static converters, and/or systems in which the static converter load predominates, it is assumed that:

- the single harmonics do not exceed 5% of the nominal voltage up to the 15th harmonic of the nominal frequency, decreasing to 1% at the 100th harmonic (see Fig 1), and that
- the total harmonic distortion does not exceed 10%.

**Figure 1 :**



**2.1.4** Higher values for the harmonic content (e.g. in electric propulsion plant systems) may be accepted on the basis of correct operation of all electrical devices.

#### 2.2 Essential services

**2.2.1** In complement of the requirements of Pt C, Ch 2, Sec 1, [3.4], the following services are to be considered as primary essential services:

- internal safety communication
- external communication
- navigation equipment.

**2.2.2** In complement of the requirements of Pt C, Ch 2, Sec 1, [3.4], the following services are to be considered as secondary essential services:

- landing radars
- ammunition elevators
- aircraft elevators
- stabilisation system
- davits for rescue boats
- aircraft handling, aircraft landing
- landing lights.

#### 2.3 Power supply

**2.3.1** Requirement Pt C, Ch 2, Sec 2, [2.1.1] is to be replaced as follows:

All electrical components are to be so designed and manufactured that they are capable of operating satisfactorily under the variations of voltage, frequency and harmonic distortion of the power supply specified from:

- STANAG 1008-9 for components designed with this standard
- [2.2] to [2.4] for the other components.

**2.3.2** Power supply to weapons and sensors, and combat management systems are to be designed so as to comply with the requirements of STANAG 1008.

**2.3.3** Requirement Pt C, Ch 2, Sec 3, [7.1.1] is to be replaced as follows:

Electrical installations are to be protected against accidental overcurrents including short-circuit.

The choice, arrangement and performance of the various protective devices are to provide complete and coordinated automatic protection in order to ensure as far as possible:

- continuity of service in the event of a fault, through coordinated and discriminative action of the protective devices, up and included to the level of section boards
- elimination of the effects of faults to reduce damage to the system and the hazard of fire as far as possible.

Note 1: An overcurrent is a current exceeding the nominal current.

Note 2: A short-circuit is the accidental connection by a relatively low resistance or impedance of two or more points in a circuit which are normally at different voltages.

## 2.4 Main switchboard

**2.4.1** When the main switchboard is constituted of two separate switchboards, connected together with at least one connection bus tie, it is not necessary to divide each main busbars of each switchboard in two parts.

## 2.5 Emergency switchboard

**2.5.1** Requirement Pt C, Ch 2, Sec 3, [2.3.1] is to be disregarded for aircraft carrier.

## 2.6 Shore supply

**2.6.1** In addition to the requirements of Pt C, Ch 2, Sec 3, [3.6], high voltage may be used for shore supply.

**2.6.2** A second shore supply is to be provided, in order to secure the ship power at quay. This shore supply may be using low voltage, and is to be connected to a different switchboard from the first shore connection.

**2.6.3** Requirement Pt C, Ch 2, Sec 3, [3.6.9] is to be disregarded and replaced as follows:

Necessary arrangements are to be provided to allow coupling of the shore supply with main switchboard, so as to avoid any black out when transferring quay supply to ship supply and vice versa.

## 2.7 Electrical equipment located in dangerous areas

**2.7.1** Cables located in dangerous areas are to be in compliance with Pt C, Ch 2, Sec 3, [10.2].

**2.7.2** Electrical equipment located in dangerous areas are to be designed in accordance with IEC 60079 standard.

**2.7.3** Electrical equipment located in dangerous areas as defined in Tab 1 are to be of a safe type appropriate for the zone. They are to be explosion group Ila and temperature class T3 minimum.

## 2.8 Electrical equipment located in special spaces

**2.8.1** Following spaces are to be considered as dangerous areas and electrical equipment related to these areas are to comply with the requirements of Pt C, Ch 2, Sec 3, [10.4]:

- paint stores or tanks
- medical product storage rooms
- workshop where solvent are used.

**2.8.2** Flour storage spaces are to be considered as dangerous areas and electrical equipment related to these areas are to have a degree of protection IP 65 and maximum surface temperature of 100°C.

**2.8.3** Following spaces are to be considered as dangerous areas and electrical equipment related to these areas are to comply with the requirements of Pt C, Ch 2, Sec 3, [10.3]:

- hydrogen distribution dispenser
- batteries rooms
- oxygen plant.

## 2.9 Electrical equipment related to aircrafts services

### 2.9.1 Landing lights

Landing area lighting.

**2.9.2** The requirements of Pt C, Ch 2, Sec 3, [3.11.5] are to be replaced by the following:

A red lighting is to be provided in the following locations:

- alleyways leading to outside spaces, and used for personnel on duty
- all rooms and access leading directly to outside spaces without airlock
- all airlock for external access
- in alleyways leading to landing area, briefing rooms and resting rooms for pilots and aviation personnel on duty
- the lifts leading to platforms
- the spaces for aviation switchboard
- the spaces related to catapult systems, aircraft elevators and associated machinery, and wire break system, having personnel on duty
- the TR5 distribution area.

The level of illumination is to be between 2 and 5 Lux on the floor in passageway and 5 Lux where reading is necessary.

Table 1 : Electrical equipment permitted in special category spaces above the bulkhead deck

| Hazardous areas | Spaces |                                                                                                                                                                                                                                                                                                                                                                                                                                      | Electrical equipment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 | N°     | Description                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Zone 1          | 1      | Areas at less than 450 mm above the deck or platforms for vehicles/aircraft, if fitted, without openings of sufficient size permitting penetration of petrol gases downward                                                                                                                                                                                                                                                          | a) any type that may be considered for zone 0<br>b) certified intrinsically safe apparatus Ex(ib)<br>c) simple electrical apparatus and components (e.g. thermo-couples, photocells, strain gauges, junction boxes, switching devices), included in intrinsically-safe circuits of category "ib" not capable of storing or generating electrical power or energy in excess of limits stated in the relevant rules, and acceptable to the appropriate authority<br>d) certified flameproof Ex(d)<br>e) certified pressurized Ex(p)<br>f) certified increased safety Ex(e)<br>g) certified encapsulated Ex(m)<br>h) certified sand filled Ex(q)<br>i) certified specially Ex(s)<br>j) cables sheathed with at least one of the following: <ul style="list-style-type: none"><li>• a non-metallic impervious sheath in combination with braiding or other metallic covering</li><li>• copper or stainless steel sheath (for mineral insulated cables only)</li></ul> |
| Zone 1          | 2      | Exhaust ventilation ducts from hangars                                                                                                                                                                                                                                                                                                                                                                                               | As stated under item 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Zone 1          | 3      | <ul style="list-style-type: none"><li>• aircraft engine test area</li><li>• loading and unloading area of fuel oil</li><li>• aircraft spaces (zone around distribution of TR5 and petrol)</li></ul>                                                                                                                                                                                                                                  | As stated under item 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Zone 2          | 4      | <ul style="list-style-type: none"><li>• areas above a height of 450 mm from the deck</li><li>• areas above a height of 450 mm from each platform for vehicles/aircraft, if fitted, without openings of sufficient size permitting penetration of petrol gases downward</li><li>• areas above platforms for vehicles/aircrafts, if fitted, with openings of sufficient size permitting penetration of petrol gases downward</li></ul> | a) any type that may be considered for zone 1<br>b) tested specially for zone 2 (e.g. type "n" protection)<br>c) pressurized, and acceptable to the appropriate authority<br>d) encapsulated, and acceptable to the appropriate authority<br>e) the type which ensures the absence of sparks and arcs and of "hot spots" during its normal operation (minimum class of protection IP55)<br>f) cables sheathed with at least a non-metallic external impervious sheath                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

3 Emergency source of electrical power and emergency installations

3.1 General

3.1.1 A self-contained emergency source of electrical power shall be provided.

3.1.2 Provided that suitable measures are taken for safeguarding independent emergency operation under all circumstances, the emergency generator may be used, exceptionally, and for short periods, to supply non-emergency circuits.

The term "exceptionally", whilst the vessel is at sea, is understood to mean conditions such as:

- a) blackout situation
- b) dead ship situation

- c) routine use for testing
- d) short-term parallel operation with the main source of electrical power for the purpose of load transfer.

Unless instructed otherwise by the Society, the emergency generator may be used during lay time in port for the supply of the ship mains, provided the requirements of Pt C, Ch 2, Sec 3, [2.4] are complied with.

3.1.3 The electrical power available shall be sufficient to supply all those services that are essential for safety in an emergency, due regard being paid to such services as may have to be operated simultaneously.

3.1.4 The emergency source of electrical power shall be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the services stated in [3.2.3] for the period specified, if they depend upon an electrical source for their operation.

**3.1.5** *The transitional source of emergency electrical power, where required, is to be of sufficient capacity to supply at least the services stated in [3.2.6] for the periods specified therein, if they depend upon an electrical source for their operation.*

**3.1.6** *An indicator shall be mounted in a suitable place on the main switchboard or in the machinery control room to indicate when the batteries constituting either the emergency source of electrical power or the transitional source of emergency electrical power referred to in Pt C, Ch 2, Sec 3, [2.3.13] and Pt C, Ch 2, Sec 3, [2.3.14] are being discharged.*

**3.1.7** *If the services which are to be supplied by the transitional source receive power from an accumulator battery by means of semiconductor converters, means are to be provided for supplying such services also in the event of failure of the converter (e.g. providing a bypass feeder or a duplication of converter).*

**3.1.8** *Where electrical power is necessary to restore propulsion, the capacity of the emergency source shall be sufficient to restore propulsion to the ship in conjunction to other machinery as appropriate, from a dead ship condition within 30 min. after blackout.*

For the purpose of this requirement only, the dead ship condition and blackout are both understood to mean a condition under which the main propulsion plant, boilers and auxiliaries are not in operation and in restoring the propulsion, no stored energy for starting the propulsion plant, the main source of electrical power and other essential auxiliaries is to be assumed available. It is assumed that means are available to start the emergency generator at all times.

The emergency generator and other means needed to restore the propulsion are to have a capacity such that the necessary propulsion starting energy is available within 30 minutes of blackout/dead ship condition as defined above. Emergency generator stored starting energy is not to be directly used for starting the propulsion plant, the main source of electrical power and/or other essential auxiliaries (emergency generator excluded).

For steam ships, the 30 minute time limit given in SOLAS can be interpreted as the time from blackout/dead ship condition defined above to light-off of the first boiler.

**3.1.9** *Provision shall be made for the periodical testing of the complete emergency system and shall include the testing of automatic starting arrangements.*

**3.1.10** *For starting arrangements of emergency generating sets, see Pt C, Ch 1, Sec 2, [3.1].*

**3.1.11** *The emergency source of electrical power may be either a generator or an accumulator battery, which shall comply with the provisions of [3.1.12] or [3.1.13], respectively.*

**3.1.12** *Where the emergency source of electrical power is a generator, it shall be:*

- a) *driven by a suitable prime mover with an independent supply of fuel having a flashpoint (closed cup test) of not less than 43°C;*
- b) *started automatically upon failure of the electrical supply to the emergency switchboard from the main source of electrical power and shall be automatically connected to the emergency switchboard; those services referred to in [3.2.6] shall then be transferred automatically to the emergency generating set. The automatic starting system and the characteristic of the prime mover shall be such as to permit the emergency generator to carry its full rated load as quickly as is safe and practicable, subject to a maximum of 45 s; and*
- c) *provided with a transitional source of emergency electrical power according to [3.1.14].*

**3.1.13** *Where the emergency source of electrical power is an accumulator battery, it shall be capable of:*

- a) *carrying the emergency electrical load without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage;*
- b) *automatically connecting to the emergency switchboard in the event of failure of the main source of electrical power; and*
- c) *immediately supplying at least those services specified in [3.2.6].*

**3.1.14** *The transitional source of emergency electrical power required by [3.1.12] item c) shall consist of an accumulator battery which shall operate without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage and be so arranged as to supply automatically in the event of failure of either the main or emergency source of electrical power at least the services in [3.2.6] if they depend upon an electrical source for their operation.*

## 3.2 Distribution of electrical power

**3.2.1** *The emergency switch board shall be supplied during normal operation from the main switchboard by an interconnector feeder which shall be adequately protected at the main switchboard against overload and short-circuit and which is to be disconnected automatically at the emergency switchboard upon failure of the main source of electrical power.*

*Where the system is arranged for feedback operation, the interconnector feeder is also to be protected at the emergency switchboard at least against short-circuit.*

**3.2.2** *In order to ensure ready availability of the emergency source of electrical power, arrangements shall be made where necessary to disconnect automatically non-emergency circuits from the emergency switchboard to ensure that power shall be available to the emergency circuits.*

**3.2.3** The emergency source of electrical power shall be capable of supplying simultaneously at least the following services for the periods specified hereafter, if they depend upon an electrical source for their operation:

- a) for a period of 36 hours, emergency lighting:
  - 1) at every muster and embarkation station and over the sides;
  - 2) in alleyways, stairways and exits giving access to the muster and embarkation stations;
  - 3) in all service and accommodation alleyways, stairways and exits, personnel lift cars;
  - 4) in the machinery spaces and main generating stations including their control positions;
  - 5) in all control stations, machinery control rooms, and at each main and emergency switchboard;
  - 6) at all stowage positions for firemen's outfits;
  - 7) at the steering gear; and
  - 8) at the fire pump, the sprinkler pump and the emergency bilge pump referred to in (d) below and at the starting position of their motors;
- b) for a period of 36 hours:
  - 1) the navigation lights and other lights required by the International Regulations for Preventing Collisions at Sea in force; and
  - 2) on ships constructed on or after 1 February 1995 the VHF radio installation required by Regulation IV/7.1.1 and IV/7.1.2 of SOLAS Consolidated Edition 1992, and, if applicable:
    - the MF radio installation required by Regulations IV/9.1.1, IV/9.1.2, IV/10.1.2 and IV/10.1.3;
    - the ship earth station required by Regulation IV/10.1.1; and
    - the MF/HF radio installation required by Regulations IV/10.2.1, IV/10.2.2 and IV/11.1;
- c) for a period of 36 hours:
  - 1) all internal communication equipment required in an emergency (see [3.2.4]);
  - 2) the shipborne navigational equipment as required by Regulation V/12; where such provision is unreasonable or impracticable the Head Office may waive this requirement for ships of less than 5,000 tons gross tonnage;
  - 3) the fire detection and fire alarm system, the fire door holding and release system; and
  - 4) intermittent operation of the daylight signalling lamp, the ship's whistle, the manually operated call points and all internal signals (see [3.2.5]) that are required in an emergency, unless such services have an independent supply for the period of 36 hours from an accumulator battery suitably located for use in an emergency;

- d) for a period of 36 hours:
  - 1) one of the fire pumps required by the relevant provisions of Part C, Chapter 4;
  - 2) the automatic sprinkler pump, if any; and
  - 3) the emergency bilge pump and all the equipment essential for the operation of electrically powered remote controlled bilge valves;
- e) for the period of time required in Pt C, Ch 1, Sec 11, [2], the steering gear if required to be so supplied;
- f) for a period of half an hour:
  - 1) any watertight doors required by Regulation II-1/15 to be power operated together with their indicators and warning signals;
  - 2) the emergency arrangements to bring the lift cars to deck level for the escape of persons. The passenger lift cars may be brought to deck level sequentially in an emergency.

**3.2.4** Internal communication equipment required in an emergency generally includes:

- a) the means of communication between the navigating bridge and the steering gear compartment
- b) the means of communication between the navigating bridge and the position in the machinery space or control room from which the engines are normally controlled
- c) the means of communication which is provided between the officer of the watch and the person responsible for closing any watertight door which is not capable of being closed from a central control station
- d) the public address system or other effective means of communication throughout the accommodation, public and service spaces
- e) the means of communication between the navigating bridge and the main fire control station.

**3.2.5** Internal signals required in an emergency generally include:

- a) general alarm
- b) watertight door indication
- c) fire door indication.

**3.2.6** The transitional source of emergency electrical power required is to supply at least the following services if they depend upon an electrical source for their operation:

- a) for half an hour:
  - 1) the lighting required by [3.2.3] item b)1) and Pt C, Ch 2, Sec 3, [3.5.6] ;
  - 2) all services required by [3.2.3] items c) 1), c) 3) and c) 4) unless such services have an independent supply for the period specified from an accumulator battery suitably located for use in an emergency.
- b) It is also to supply power to close the watertight doors as required by Regulation II-1/15.7.3.3, but not necessarily all of them simultaneously, unless an independent temporary source of stored energy is provided. Power to the control, indication and alarm circuits as required by Regulation II-1/15.7.2, for half an hour.

3.3 Low-location lighting

3.3.1 Passenger ships are to be provided with a low-location lighting (LLL) system in accordance with Pt C, Ch 4, Sec 8, [2.3.2].

Where LLL is satisfied by electric illumination, it is to comply with the following requirements.

3.3.2 The LLL system is to be connected to the emergency switchboard and is to be capable of being powered either by the main source of electrical power, or by the emergency source of electrical power for a minimum period of 60 minutes after energizing in an emergency.

3.3.3 The power supply arrangements to the LLL are to be arranged so that a single fault or a fire in any one fire zone or deck does not result in loss of the lighting in any other zone or deck. This requirement may be satisfied by the power supply circuit configuration, use of fire-resistant cables complying with IEC Publication 60331: Fire characteristics of electrical cables, and/or the provision of suitably located power supply units having integral batteries adequately rated to supply the connected LLL for a minimum period of 60 minutes.

3.3.4 Single lights and lighting assemblies are to be designed or arranged so that any single fault or failure in a light or lighting assembly, other than a short-circuit, will not result in a break in visible delineation exceeding 1 metre.

3.3.5 Light and lighting assemblies are to be flame-retardant as a minimum, to have an ingress protection of at least IP55 and to meet the type test requirements as specified in Pt C, Ch 3, Sec 6, Tab 1.

3.3.6 The LLL system is to be capable of being manually activated by a single action from the continuously manned central control station. It may, additionally, be continuously operating or be switched on automatically, e.g. by the presence of smoke within the space(s) being served.

3.3.7 When powered, the systems are to achieve the following minimum luminance:

- for any planar source: 10 cd/m<sup>2</sup> from the active parts in a continuous line of 15 mm minimum width
- for any point source: 35 mcd in the typical track directions of approach and viewing which is to be considered:
  - for sources which are required to be viewed from a horizontal position, i.e. deck mounted or horizontally bulkhead mounted fittings, within a 60° cone having its centre located 30° from the horizontal mounting surface of the point source and in line with the track direction; see Fig 2
  - for sources which are required to be viewed vertically, i.e. the vertical LLL marking up to the door handles, within a 60° cone having its centre located perpendicular to the mounting service of the point source; see Fig 3.

Spacing between sources is not to exceed 300 mm.

Figure 2 :

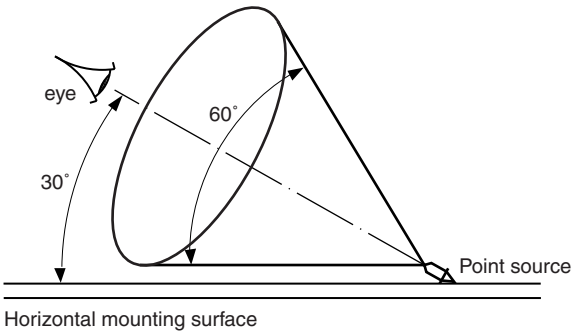
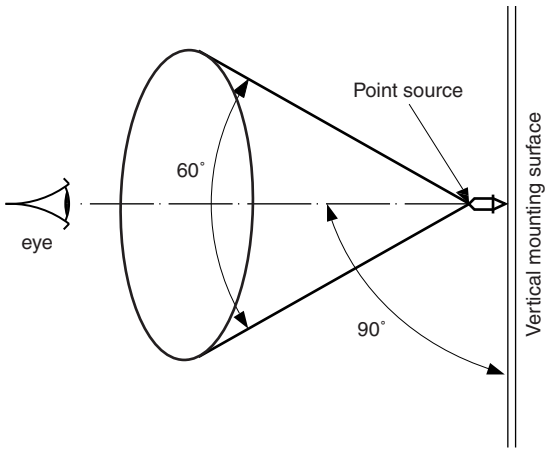


Figure 3 :



3.3.8 The lights or lighting assemblies are to be continuous except as interrupted by constructional constraints, such as corridors or cabin doors etc., are to provide a visible delineation along the escape route and, where applicable, are to lead to the exit door handles. Interruption of the LLL system due to constructional constraints is not to exceed 2 metres.

3.3.9 The lighting is to be provided on at least one side of the corridor or stairway. In corridors and stairways in excess of 2 metres width, lighting is to be provided on both sides.

3.3.10 In corridors the lighting is to be installed either on the bulkhead within 300 mm of the deck or, alternatively, on the deck within 150 mm of the bulkhead.

3.3.11 In stairways the lighting is to be installed within 300 mm above the steps such that each step may be readily identified from either above or below that step. The top and bottom steps are to be further identified to show that there are no further steps.

4 General emergency alarm and public address systems

4.1 General emergency alarm system

4.1.1 An electrically operated bell or klaxon or other equivalent warning system installed in addition to the ship's whistle or siren for sounding the general emergency alarm signal is to comply with the following requirements.