INTRODUCTION TO THE RULES

DECEMBER 1997

CONTENTS

100 Introduction to users ........................................... 3
110 General ................................................................. 3
120 How to use the rules ................................................ 3
200 The Rules ................................................................. 3
210 Format ................................................................. 3
220 Numbering and cross references ..................................... 4
230 Index and tables of contents ......................................... 4
240 Amendments ............................................................ 4
250 Reprints from the rules ................................................ 4
260 Special Rule Issue ..................................................... 4
300 Guidelines, Notes and Lists ........................................... 4
310 General ................................................................. 4
320 Guidelines ............................................................. 4
330 Classification Notes .................................................. 4
340 Certification Notes .................................................... 4
350 Lists of Approved Manufacturers and Type Approved Products 5
400 Amendments and Corrections .......................................... 5
410 Introduction ........................................................... 5
420 Amendments and corrections ........................................... 5
The Rules for Boats include a standard and certification system for newbuildings through the requirements in Part 3 and Part 4.

These assignments secure the quality of ships, mobile offshore units and fixed offshore installations, facilities and systems, and carries out research in connection with these functions. Moreover, the Society, provided its integrity is not impaired, may perform assignments which utilize its knowledge or which contribute to develop knowledge that will be required for the performance of these assignments.

The Foundation was established in 1978 as a direct continuation of the association The Norske Veritas which was established in 1864.

This new rule booklet was approved by the Board in August 1997.

INTRODUCTION TO RECREATIONAL CRAFT

The EU Directive for Module Certification and CE marking of Recreational Craft less than 24 meter of length came into force 16 June 1996, and will become mandatory 16 June 1998. DNV has become a Notified Body for this Directive and offers certification services to the Nordic and UK boat industry.

As this Directive affects both classification and certification services, DNV has developed a system which makes the two certification systems work together. DNV services are developed together with the boat industry, which have been served with DNV certification services for more than 25 years. The Nordic Maritime Administrations, which have been certification partners for several years in accordance with the Nordic Boat Standard, have become the Market Surveillance Bodies under the EU Directive. DNV as a Notified Body will be subject to auditing by the Norwegian Maritime Administration.

The development of the new Rules for Boats is intended to be a step by step process and will also include other types of boats which are not covered by other Rules or regulations.

Part 2 of the Rules may in the future contain standards within the most vital safety aspects, and is not considered necessary at this stage as the requirements for Recreational Craft given in Pt.4 Ch.1 are adequate for the first issue.

The Rules for Boats include a standard and certification system for newbuildings through the requirements in Part 3 and Part 4, together with the requirements for certification of newbuildings in Pt.1 Ch.2.

The Rules also contain an optional standard and system for classification in the service period for craft of length 12 metres and above through the requirements in Part 3 and Part 4, together with requirements in Pt.1 Ch.3.

The Rules also contain a separate issue for Recreational Craft as part of rules covering vessels which are not regulated by any IMO instrument.

These rules supersede the Rules for Leisure Boats 1983 and are an alternative to the requirements of:

- Nordic Boat Standard, Recreational boats 1990

These rules also refer to:

- Rules for Wooden Vessels 1970

The certification and classification system presented by these Rules are applicable in combination with the technical requirements in the above mentioned Rule sets.

© Det Norske Veritas AS 1997

Data processed and typeset by Division Technology and Products, Det Norske Veritas AS

Printed in Norway by Det Norsk e Veritas AS

99-12-11 J0814-PO Ch1.doc

12.97 1000

It is agreed that save as provided below Det Norske Veritas, its widliad sales, bodies, officers, directors, employees and agents shall have no liability for any loss, damage or expense allegedly caused directly or indirectly by their mistake or negligence, breach of warranty, or any other act, omission or error by them, including gross negligence or wilful misconduct by any such person with the exception of gross negligence or wilful misconduct by the governing bodies or senior executive officers of Det Norske Veritas. This applies regardless of whether the loss, damage or expense has attained anyone with whom Det Norske Veritas has a current or a third party who has acted or relied on decisions made or information given by or on behalf of Det Norske Veritas. However, if any person uses the services of Det Norske Veritas or its subsidiaries or relies on any decision made or information given by or on behalf of them and in consequence suffers a loss, damage or expense proved to be due to their negligence, omission or default, then Det Norske Veritas will pay by way of compensation to such person a sum representing his proved loss. In the event Det Norske Veritas or its subsidiaries may be held liable in accordance with the sections above, the amount of compensation shall under no circumstances exceed the amount of the loss, if any, charged for their particular service, decision, advice or information. Under no circumstances whatsoever shall the individual or individuals who have personally caused the loss, damage or expense be held liable. In the event that any provision in this section shall be invalid under the law of any jurisdiction, the validity of the remaining provisions shall not in any way be affected.
PART 0  INTRODUCTION
Chapter 1  Introduction to the Rules .................................................................... December 1997
Chapter 2  Rule Preamble ....................................................................................... December 1997
Chapter 3  Classification Parameters ...................................................................... December 1997

PART 1  GENERAL REGULATIONS
Chapter 1  Classification ........................................................................................... December 1997
Chapter 2  Certification of Newbuildings .................................................................... December 1997
Chapter 3  Classification of Vessels in Service ............................................................. December 1997

PART 3  STRUCTURAL DESIGN
Chapter 1  Design Loads ............................................................................................ December 1997
Chapter 2  Steel and Aluminium Constructions .............................................................. December 1997
Chapter 3  Composite Constructions ........................................................................... December 1997
Chapter 4  Thermoplastic Constructions ..................................................................... December 1997

PART 4  TYPE AND SERVICE NOTATIONS
Chapter 1  Recreational Craft ...................................................................................... December 1997

PART 7  MATERIALS, COMPONENTS AND EQUIPMENT
Chapter 1  Approval of Raw Materials ....................................................................... December 1997
100 Introduction to users

110 General

111 This booklet gives brief instructions to the users.

112 Format and editorial details of the Rules are described in the following to facilitate easy use.

113 The requirements of these Rules are established by the Society on basis of service experience and safety records of representative boat types, size and building materials together with knowledge and statistics on weather conditions related to the various service areas.

114 The certification systems in these Rules for Boats are somewhat different compared to other classification rules by the Society, as the Rules for Boats are harmonised with the European Module Certification system.

115 These rules are applicable if the size, building material and service of the vessel are in compliance with the limitations of these Rules.

120 How to use the rules

121 The content of the Rules is such that:

Part 1 covers the certification and classification system
Part 2 covers general safety standards for various subjects
Part 3 covers standards for structural designs
Part 4 cover specific for each type of vessel
Part 5 cover additional safety standards
Part 6 cover standards for equipment
Part 7 cover standard for materials and components
Part 8 cover additional standards related to national requirements.

122 It is recommended to start reading Pt. 1 to understand the systematic and the step by step certification towards a final class certificate.

Note:
For lifeboats the separate issue gives requirements for certification of newbuildings only.
End of note

123 It is then recommended to study the relevant chapter in Pt. 4 as this chapter specifies the requirements for the actual type and service of the vessel, and refer to the relevant chapters of Pt. 2 and Pt. 3. Pt. 5 to Pt. 8 will be applicable for specific components and systems additional to the craft itself.

Figure 1 Structure of Rule parts

200 The Rules

210 Format

211 The Rules for Boats are planned later to be published as booklets intended for ring binders. Each part/chapter is therefore issued as a separate booklet identified by name, date of issue and a two-digit number, e.g. Pt. 0 Ch. 1 for this booklet.

212 The introduction booklet giving current status of the Rules in the form of dates relevant to each chapter will be issued with each set of amendments.

213 The changes introduced in the latest edition of each chapter will be stated on the page immediately after the front page.

214 The first paragraph in each chapter will normally be termed General Requirements and will contain subsections covering such aspects as application of the Rules, definitions of symbols and terms, list of documentation etc.
220 Numbering and cross references

221 The numbering system is based on the ISO index system.

222 To identify a specific paragraph it is necessary to give the specific part and chapter together with the paragraph i.e. Pt. 0 Ch. I 222 for this paragraph.

223 Figures are numbered in increasing order within each chapter, e.g. Figure 1, Figure 2 etc.

224 Tables are numbered in increasing order within each chapter, e.g. Table 1, Table 2 etc.

225 Each chapter is written as self-contained as possible. Cross-references are generally given at the highest level consistent with feasibility to find the subject matter:

a) From part to part, e.g. see Pt. 2 Ch. 1 (i.e. down to chapter)

b) From chapter to chapter within the same part, e.g. see Ch. I 200 (i.e. down to section). Reference to sub-section, e.g. Ch. I 220 may be used where necessary for clarity.

c) Within a chapter
   e.g. section to section, see 100
   e.g. within a section, see 110
   e.g. within a paragraph, see 113.

230 Index and tables of contents

231 A table of contents is given at the beginning of each chapter. A table of sections is given on the front page of the chapter, providing the starting page number for each section within the chapter. A complete table of sections, sub-sections and main items is also included giving page number references at sub-section level.

240 Amendments

241 Technical amendments of the rules are the results of formal proposals from the technical staff of the Society and are based on practical experience from units in service as well as comprehensive theoretical studies, research and development. These proposals are discussed with regional technical committees consisting of representatives of builders, owners, maritime governmental bodies and insurance company associations before being submitted to the Board for adoption.

242 Amendments to the rules may be undertaken at any time, but normally twice a year, in January and in July. Amendments will be forwarded to subscribers of the Rules.

250 Reprints from the rules

251 Reprints from the rules are available from the Society on request. There is currently no subscription scheme for reprints. While the Society will publish details of amendments to the Rules in its own magazines, no special notification of amendments to buyers of reprints will be undertaken.

260 Special Rule Issue

261 As a ring binder contains all kinds of rules, it may be decided to issue paperback rules consisting of relevant parts and chapters for specific branches, i.e. for the recreational composite boat industry, boat equipment industry etc.

262 Specific requirements may be applicable to some domestic markets and may be issued as a paperback.

300 Guidelines, Notes and Lists

310 General

311 In an effort to aid the various parties involved in certification and classification, the Society has issued Guidelines and Notes giving practical and other relevant information as well as guidance. These publications are available as a complementary volume to the rules, on a purchase or subscription basis. Each of the Guidelines and Notes may also be purchased individually.

312 Products which are to be approved for installation onboard a vessel classed with the Society, may be granted Type Approval. The Society has issued Lists of Approved Manufacturers and Type Approved Products containing the names of manufacturers and types of products which have been granted approval. The approval is time limited and updated lists are normally published annually.

320 Guidelines

321 Guidelines are publications which give information and advice on technical and formal matters related to the design, building, operating, maintenance and repair of vessels and other objects, as well as the services rendered by the Society in this connection.

330 Classification Notes

331 Classification Notes are publications which give practical information on classification of ships and other objects.

340 Certification Notes

341 Certification Notes are publications which contain principles, accept criteria and practical information related to the Society’s consideration of objects, personnel, organisations, services and operations, in connection with issuance of certificates or declarations, which are not necessarily related to classification.
350 Lists of Approved Manufacturers and Type Approved Products

351 Lists of Approved Manufacturers.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Companies with Veritas Certified Quality System</td>
</tr>
<tr>
<td>101</td>
<td>Metallic Materials</td>
</tr>
</tbody>
</table>

352 Lists of Type Approved Products.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non-metallic Materials</td>
</tr>
<tr>
<td>2</td>
<td>Welding Consumables</td>
</tr>
<tr>
<td>3</td>
<td>Structural Equipment, Containers, Cargo Handling and Securing Equipment</td>
</tr>
<tr>
<td>4</td>
<td>Machinery Components</td>
</tr>
<tr>
<td>5</td>
<td>Mechanical Equipment and Piping</td>
</tr>
<tr>
<td>6</td>
<td>Electrical Equipment and Systems</td>
</tr>
<tr>
<td>7</td>
<td>Instrumentation and Automation</td>
</tr>
<tr>
<td>8</td>
<td>Fire Restricting materials and Fire Technical Equipment</td>
</tr>
<tr>
<td>9</td>
<td>Drilling and Well Control Equipment</td>
</tr>
</tbody>
</table>

400 Amendments and Corrections

410 Introduction

411 This section includes amendments and corrections decided by the Board, but not incorporated in the current Rule chapters. Information on the coming into force date of new amendments is given on the cover inside of this Introduction issue. Previous amendments are referred to in earlier issues.

420 Amendments and corrections

(not relevant for this issue)
PART 0 CHAPTER 2

RULE PREAMBLE

DECEMBER 1997

CONTENTS

100 Introduction .............................................................. 3
110 Purpose .................................................................... 3
120 Terminology ............................................................ 3
130 Certification ........................................................... 3
140 Classification ........................................................... 4
150 Rules and Service Experience ....................................... 4
200 The certification system ............................................... 4
210 Obligations .............................................................. 4
220 Who needs certificates? ................................................ 4
230 Recognition of the Society ............................................. 4
240 Certification of newbuildings ........................................ 5
250 Classification in the operational phase ............................ 5
260 Owner's duties .......................................................... 5
300 Remuneration .......................................................... 6
310 Fee system .............................................................. 6
400 Support services ....................................................... 6
410 General ................................................................. 6
420 Pre-contract support .................................................. 6
430 In-service support ..................................................... 6
440 Limitations .............................................................. 6
FOREWORD

Det Norske Veritas is a free-standing, autonomous and independent Foundation with the object of safeguarding life, property and the environment at sea and ashore.

Det Norske Veritas AS, a fully owned subsidiary Society of the Foundation, undertakes classification and certification and secures the quality of ships, mobile offshore units and fixed offshore installations, facilities and systems, and carries out research in connection with these functions. Moreover, the Society, provided its integrity is not impaired, may perform assignments which utilize its knowledge or which contribute to develop knowledge that will be required for the performance of these assignments.

The Foundation was established in 1978 as a direct continuation of the association The Norske Veritas which was established in 1864.

This new rule booklet was approved by the Board in August 1997.
100 Introduction

110 Purpose

111 The preamble to the Rules explains the system of classification and certification, how it works, conditions of validity, and its interaction with statutory control. This information is to a large extent implied by the Rules, but a brief clarification of the essential points in one place is considered useful.

112 This information is not in any way to be understood as Rule requirements.

120 Terminology

121 Det Norske Veritas (DNV) is an autonomous and independent Foundation with the object of safeguarding life, property and the environment at sea and ashore.

DNV undertakes classification and certification and ensures the quality of ships, mobile offshore units, fixed offshore structures, facilities and systems, and carries out research in connection with these functions.

DNV operates a worldwide network of survey stations and is authorised by more than 120 national administrations to carry out surveys and, in most cases, issue certificates on their behalf.

122 The Society signifies DNV.

123 The Board signifies the Executive Board of DNV through its Chairman who is the President and CEO of DNV.

124 National Authorities denotes the Administration of any country of registry.

125 Client means the party having requested service by the Society. In cases where clients have authorised another party to operate on their behalf, such party is also regarded as the Client.

126 IMO is the International Maritime Organization.

127 ISO is the International Organization for Standardization.

128 IACS is The International Association of Classification Societies, and recognised classification society means a classification society which is a full member of IACS.

129 Tentative Rules are Rules applying to new fields to which the Society reserves the right to make adjustments during a period in order to obtain the intention reflected in the Rules.

130 Certification

131 Certification is used within the classification system to verify conformity with the rule requirements in the design and construction phase by application of one or a combination of the certification modules as specified in Pt. 1 Ch. 1 and Ch. 2.

132 The DNV Certification system for boats is based on the EU Module Certification system. When the Society is acting as Notified Body under an EU Directive, or in other cases when so requested, the special requirements for CE marking and certificates as specified under the various certification modules shall be applied, thus obtaining full compliance with the EU modules.

133 When a certification module or combination of modules have been applied in its entirety for the purpose of CE marking this will be signified on the Certificate.

134 The Society issues Certificates based upon the following modules:

Module B Type Examination
Module D Production Quality Assurance
Module F Product Verification
Module G Unit Verification.

135 Module Certificates verify the compliance with the requirements at the time of issue of the certificate and does not involve survey arrangements in the operating phase.

136 Applying Module Certification implies that the design and construction is verified through the certification process as follows:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Module B or Module G</td>
</tr>
<tr>
<td>Production</td>
<td>Module D or Module F or Module G</td>
</tr>
</tbody>
</table>

137 DNV Module Certification implies certification on basis of the various modules as follows:

<table>
<thead>
<tr>
<th>Certification</th>
<th>Modules *)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type Approval</td>
<td>B: Type examination</td>
</tr>
<tr>
<td>Production Certification</td>
<td>D: Production Quality Assurance + B</td>
</tr>
<tr>
<td>Product Certification</td>
<td>F: Product Verification + B</td>
</tr>
<tr>
<td>Unit Certification</td>
<td>G: Unit Verification</td>
</tr>
</tbody>
</table>

*) EU Modular Approach designations of the modules.

138 When the Society is carrying out Module B certification as Notified Body under a Directive, an EC Type Examination Certificate will be issued.
140 Classification

Note:
Not applicable for lifeboats

End of note

141 Classification is the established system to certify the safety and quality standard throughout the life of an individual vessel.

142 Classification assigns a vessel to a specific class notation defined by the requirements of the Rules for the notation to identify a safety and quality standard of the vessel adequate for the service, trade, equipment and conditions for use.

143 Classification involves a commitment by the owner to operate the vessel within the conditions given by the Society and to undergo a system of periodical surveys during the operating phase of the craft.

144 For new constructions the Classification Certificate for the operating phase is issued on basis of a Module Certificate confirming that the vessel is built in accordance with the Rules.

145 The Society issues Classification Certificates based on Certificates issued in accordance with the following certification modules:
(i) Module B + Module F *)
(ii) Module G

*) On the condition that survey according to Pt.1 Ch.2 430 is applied.

For vessels not holding such a certificate the Classification Certificate may be issued on basis of the class entry procedures of Pt.1 Ch.3.

146 The Classification Certificate is issued upon assignment or renewal of class. Its validity is maximum five years subject to successful completion of periodical surveys.

150 Rules and Service Experience

151 The Rules are developed and published by the Society even when the Rules are based on and cover mandatory regulations as IMO Conventions or EU Directives.

152 In addition to the technical requirements of the Rules, documentation requirements and certification procedures are given.

153 The Society revises the rules on basis of available experience feedback from service and applies additional requirements if found necessary.

154 Module Certification and Classification is different from conformity certification as the overall aim is to obtain the necessary safety standard based on service experience in addition to conformity with industrial standards.

200 The certification system

210 Obligations

211 Module Certification and Classification according to the Rules are aimed at safeguarding life and property at sea, and the environment as a consequence of operation of vessels. It implies a process of verifying standards against a set of requirements laid down in the Rules established by the Society.

212 Module Certification and Classification is not performed as a substitute for the client’s own quality and safety control and related duties, or the client’s obligations to third parties, nor to relieve the client of any consequences of default.

213 The Society keeps complete files on all vessels covering the documentation required by the Rules. Reports will not be disclosed to any party, apart from the National Authorities involved, without the owner's consent. The Society also undertakes all reporting to National Authorities required in connection with the safety certificates.

220 Who needs certificates?

221 Module Certificates and Classification Certificates serve as a verification system for a number of parties who have special interest in the safety and quality of ships, vessels and boats, such as:

- National Authorities, who need assurance that vessels are safe to sail on and represent a minimum hazard to their surroundings.
- Insurance underwriters, who need to know the standard of the vessel in order to assess the insurance fee for the vessel.
- Owners, who need the technical standard of the rules as basis for building contracts and to document the standard when seeking insurance or financing, or when hiring out or selling the vessel.
- Building yards and sub-contractors, who use the Rules as a tool for design and construction, as required by their client, to avoid technical barriers to trade and to obtain access to markets which require certificates.
- Manufacturers, who use certification as a part of their documentation when they place their products on the market.
- Finance institutions, who use the classification standard as a documented indicator of the maintenance and value of the vessel in service.
- Charterers or cargo owners, who require confirmation of the standard before hire.

230 Recognition of the Society

231 The Society is recognised as an international Classification Society by virtue of its position in the marine industry, founded on the following criteria:
Independence

- By classing a substantial share of the world fleet and through high equity and financial independence, the economic basis for independent decisions in classification matters is ensured.

High technical competence

- Extensive research and development in class related fields sustains a process where the Rules are continuously extended and improved in pace with new technology and experience gained. Research and development also contribute to a high level of staff competence.
- Continuous monitoring of ships in service ensures valuable feedback from casualties, damage incidents and operational experience in general. Analyses of these data are one important source of improvements of the Rules.
- The Society runs a scheme for training and qualification of its technical personnel to ensure correct, uniform quality of approval and survey work throughout the organisation.

Worldwide survey station network

- The Society operates survey stations in ports all over the world. Efficient reporting and information systems support the operations, and provide service to clients and National Authorities.

240 Certification of newbuildings

241 The builder initiates the process by submitting a request for certification or classification to the Society. In response to a list of documentation issued by the Society for the specific class notations requested, the builder and sub-suppliers submit plans, specifications, related technical descriptions and data, including specification of materials as required by the Rules for approval.

242 After examining the above documents, the Society informs the builder and sub-supplier whether the design and arrangement of structure, machinery and equipment is acceptable. If not, the Society may propose modifications needed to meet the requirements.

243 During the building period the Society carries out surveys at the building yard and its suppliers. The method and extent of survey will be decided by the Society based on the acceptance of their quality system and the certification system to be applied.

244 The purpose of the surveys is to verify that the construction, components and equipment satisfy the Rule requirements and are in accordance with the approved plans, that required materials are used, and that functional tests are carried out as prescribed by the Rules.

245 When the vessel is completed and the Society is satisfied that the requirements specified for the vessel in question have been met, the appropriate class notation will be assigned and confirmed by the issuance of a certificate.

250 Classification in the operational phase

Note:
Not applicable for lifeboats

End of note

251 Compliance with the Rule requirements in the operational phase is verified by the Society through a system of periodical surveys. The most comprehensive survey is the one carried out in connection with the renewal of the five-yearly classification certificate. During the five-year period the vessel undergoes periodical surveys covering various parts, equipment and systems, depending on the class notation assigned.

252 In order to confirm retained validity of class, the Society evaluates the extent of possible sustained damage and verifies ensuing repairs. Deferred repairs may be accepted by the Society, but always associated with a maximum time limit.

253 The Rules allow periodical surveys to contain an element of sampling. This sampling must be sufficient to enable the surveyor to obtain a proper assessment of the condition of the vessel. This assessment is based amongst other things on type, age and technical history of the vessel.

254 Results of the surveys are reported to the owners and to the Society's central office for updating records. Special findings are also recorded and used as basis for updating and development of the Rules.

255 The Society's Register Book is available for supplying information on vessels' main particulars and details of their classification.

260 Owner's duties

261 In order to maintain valid class, the classification system specifies the following to be observed by the owner:

- The vessel has to be competently handled in accordance with the Rules.
- The vessel has to be maintained to Rule standard at all times. Any Conditions of Class have to be carried out as specified.
- The vessel has to undergo prescribed periodical and renewal surveys, as well as surveys of damage, repairs, conversions and alterations.
- The Society must be furnished with all information that may influence its decisions in connection with classification.

Failure to meet any of these requirements may lead to termination of valid class and withdrawal of all class and statutory certificates.
262 To assist the owner in this regard the Society supplies regular status reports on certificates, surveys carried out and becoming due, and possible Conditions of Class.

300 Remuneration

310 Fee system

311 Remuneration is normally based on a fee system, in which the Society invoices each type of approval, survey and certification according to a Basic Scale of Fees. The Basic Scale of Fees is developed by taking into consideration the amount of work needed to execute, process and follow up the service in question, as well as the items surveyed. The fees also cover investment and development costs of the Rules as well as maintenance of a worldwide survey network, central service support system, etc. Price level and costs vary from country to country and are therefore reflected in the fees charged.

400 Support services

410 General

411 The staff of the Society represents a significant accumulation of knowledge and practical experience in all marine related technical fields. This is an asset often drawn on by the industry in matters related to module certification and classification.

412 The expertise of the Society is available to the owner at any time when needed in connection with operating problems, damage and casualties.

420 Pre-contract support

421 Co-operation with the Society early in the design stage, before certification is requested and any contract is signed, is usually very beneficial to both yard and owner. Different technical solutions may be evaluated in terms of cargo flexibility and cost, thus contributing to a more efficient vessel, and ensuring that all safety aspects as specified by the Rules are taken care of. In this way expensive changes late in a project may be avoided.

430 In-service support

431 Similar services are given in connection with vessels in operation. Alternative ways of repairs may be indicated, acceptable distributions of cargo or ballast to alleviate overstressing or provide stability may be computed in case of damage.

440 Limitations

441 Three main restrictions prevail on the Society when undertaking certification and classification support work:

- The Society does not carry out complete, conceptual design of vessels. In cases where the Society has been involved in design support, the plans and calculations must still be independently evaluated by the Society before being accepted.
- Information received from clients is not disclosed and used in support work.
- Support services are limited to aspects related to the safety and quality of the vessel and to safeguard the environment according to the main objective of the Society.
PART 0 CHAPTER 3

CLASSIFICATION PARAMETERS

DECEMBER 1997

CONTENTS

100 General principles .................................................... 3
110 Application ............................................................ 3
120 The rules matrix ....................................................... 3
130 Type and service notations ........................................... 3
140 Size of the vessel ....................................................... 3
150 Speed of the vessel ..................................................... 4
160 Number of persons onboard ........................................... 4
200 Service conditions ..................................................... 4
210 Purpose ................................................................. 4
220 Scope ................................................................. 4
230 Class notations .......................................................... 4
240 Ice conditions ........................................................ 5
250 Service conditions .................................................... 5
260 Theoretical basis for seastate assessment ...................... 5
300 Basic safety requirements .......................................... 7
310 Safety principle ....................................................... 7
320 Main subjects ........................................................ 7
330 Relevant classification parameters ................................ 8
340 Minimum size ........................................................ 8
FOREWORD

Det Norske Veritas is a free-standing, autonomous and independent Foundation with the object of safeguarding life, property and the environment at sea and ashore.

Det Norske Veritas AS, a fully owned subsidiary Society of the Foundation, undertakes classification and certification and secures the quality of ships, mobile offshore units and fixed offshore installations, facilities and systems, and carries out research in connection with these functions. Moreover, the Society, provided its integrity is not impaired, may perform assignments which utilize its knowledge or which contribute to develop knowledge that will be required for the performance of these assignments.

The Foundation was established in 1978 as a direct continuation of the association The Norske Veritas which was established in 1864.

This new rule booklet was approved by the Board in August 1997.
100 General principles

110 Application

111 This chapter is applicable to recreational craft as defined under these Rules. All vessels are to be assigned a class notation with service condition as classification parameter.

112 This chapter contains the basic principles for classification parameters for all vessels. Specific requirements for each type and service notation are given in relevant parts of the Rules.

113 This chapter is also applicable for the chapters for main class requirements and relevant chapters for Structural Design and Type and Service Notations.

114 This chapter is also applicable for the relevant Additional Class Notations when such notations are requested.

115 This chapter is not applicable for chapters on Materials, Components and Equipment as such chapters only consider the units and not the vessel itself.

120 The rules matrix

121 The basic text of the Rules is giving requirements for the main class notation DNV and Type and Service notations in addition. The DNV standard is basic and the notations Barge, Fisher, Cargo, Lifeboat or Recreational Craft represent all different technical standards.

122 Most of the requirements of the Rules are related to the size of the vessel represented by the length, the displacement of the vessel or the Gross Tonnage.

123 The speed of the vessel is another important parameter and influence loading and operational safety. The actual speed is used in some respect, but the speed is not given on the Certificate as a parameter. The maximum engine power is a classification parameter.

124 The number of persons onboard is an important parameter as it is far more difficult to obtain safety for a large number of persons compared to rather few, in particular with respect to evacuation and rescue assistance. Maximum number of persons is given as a classification parameter.

125 The technical requirements of the Rules differ for the various service conditions and these classification parameters are used:

<table>
<thead>
<tr>
<th>CLASSIFICATION PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Type and Service Notations</td>
</tr>
<tr>
<td>• Size of the craft by length, displacement or tonnage</td>
</tr>
<tr>
<td>• Engine power and speed of the craft</td>
</tr>
<tr>
<td>• Number of persons onboard</td>
</tr>
<tr>
<td>• Service conditions</td>
</tr>
</tbody>
</table>

126 The overall principle for the matrices of classification parameters is that equivalent safety shall be obtained although the technical requirements may be different.

130 Type and service notations

131 The various Type and Service notations are based on relevant statutory documents.

132 The notation Recreational Craft is based on the EU Recreational Craft Directive.

140 Size of the vessel

141 The requirements related to the size of the vessel in terms of length or displacement are technical and are not necessarily required to be mentioned on the certificate for a specific vessel.

142 The sign of the vessels affects the requirements for strength, freeboard and closing appliances.

143 The safety requirements may also be related to the size of the craft expressed by the tonnage.

Note:
The tonnage is an expression for the volume of the craft and the following limits are commonly used in national regulations:

<table>
<thead>
<tr>
<th>Tonnage</th>
<th>Typical requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 6 GRT</td>
<td>Minimum size for commercial vessels</td>
</tr>
<tr>
<td>&gt; 20 GRT</td>
<td>Survey of ships in service</td>
</tr>
<tr>
<td>&gt; 25 GRT</td>
<td>Tonnage measurement for registration</td>
</tr>
<tr>
<td>&gt; 50 GRT</td>
<td>Certification of officers</td>
</tr>
<tr>
<td>&gt; 100 GRT</td>
<td>Passenger ship compliance</td>
</tr>
<tr>
<td>&gt; 150 GRT</td>
<td>Standard ship compass and steering compass</td>
</tr>
<tr>
<td>&gt; 200 GRT</td>
<td>Cert. of officers, ILO 133 cabins</td>
</tr>
<tr>
<td>&gt; 300 GRT</td>
<td>SOLAS III, Radio equipment, alt. GMDSB</td>
</tr>
<tr>
<td>&gt; 400 GRT</td>
<td>MARPOL Annex I, Oil pollution prevention</td>
</tr>
<tr>
<td>&gt; 500 GRT</td>
<td>SOLAS Convention for cargo ships</td>
</tr>
</tbody>
</table>

End of note

144 A rough estimate of tonnage related to size of craft is given by Figure 1.

DET NORSKE VERITAS
Figure 1 Tonnage/size relation

145 Tonnage is given on a separate certificate.

150 Speed of the vessel

151 The speed of the vessel is a classification parameter with respect to strength and operational safety. The speed performance is documented by sea trial.

152 Restrictions with respect to speed are also given by specification of a maximum engine power.

153 The classification parameters on speed are normally used for the following levels:

<table>
<thead>
<tr>
<th>SPEED</th>
<th>CRITICALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 knots</td>
<td>Slow speed</td>
</tr>
<tr>
<td>&lt; 10 knots</td>
<td>Low speed</td>
</tr>
<tr>
<td>&lt; 25 knots</td>
<td>Medium speed</td>
</tr>
<tr>
<td>&gt; 25 knots</td>
<td>High speed</td>
</tr>
</tbody>
</table>

160 Number of persons onboard

161 The number of persons onboard is an important classification parameter, in particular for craft conveying persons of different sex, age and health and being unexperienced to sea, such as passengers onboard a passenger vessel.

162 The classification of number of persons under these Rules is based on the following groups and limitations:

<table>
<thead>
<tr>
<th>Number of persons</th>
<th>Safety level for</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td>Private boats and taxiboats</td>
</tr>
<tr>
<td>5 - 12</td>
<td>Charterboats and seacabses</td>
</tr>
<tr>
<td>13 - 36</td>
<td></td>
</tr>
<tr>
<td>37 - 75</td>
<td></td>
</tr>
</tbody>
</table>

163 Number of persons above 75 has to be specially considered under these rules.

200 Service conditions

210 Purpose

211 Most requirements are related to service conditions, both due to the design seastate, the distance of the voyage, the predictable weather conditions and the possibility to get ashore or get rescue assistance.

212 The purpose of this section is to standardise the use of service conditions to enable the users to comply with the conditions laid down for the use of the different types of craft.

220 Scope

221 The service conditions are not to be understood as a geographical restriction, but as a definition of the typical seastate for such condition as defined by these Rules.

222 The technical standard for a specific service condition is based on this defined seastate condition and the time and fetch to develop the seastate.

Note:
Although weather conditions close to a coastline may be just as severe as on the oceans, the philosophy of the class notations for service conditions is that the captain can avoid too heavy weather conditions for his vessel when the vessel operates within a service condition. He can decide to stay in harbor or return to harbor if the weather forecast indicates conditions exceeding the maximum for his vessel.

End of note

223 It is the responsibility of the captain of the vessel to sail within the service condition for his vessel.

224 Maritime Authorities and Harbour Captains may decide geographical restrictions for a vessel based on local knowledge on weather and seastate conditions.

225 The scope of the classification is to establish adequate safety standard related to the defined service conditions of the class notation and make the service condition of the vessel known to the captain and flag authority of the vessel by the notation on the certificate.

226 A vessel found unacceptable for one service condition, may well be accepted for a more restrict service condition.

227 In particular vessels with reduced technical standard, i.e. old wooden vessels or corroded steel vessels, may be assigned a class notation as far as the vessel at least complies with the requirements of the most restrict service condition.

230 Class notations

231 The notation for service condition shall be assigned between the main class notation DNV and the relevant type and service notation for the vessel.

232 The notation for service condition follows the class periods for the main class.

233 The service condition Ocean specifies a safety standard for extended voyages where the vessel is capable of meeting severe weather conditions and emergencies without outside assistance. The trade is unrestricted except for arctic waters and other waters with ice conditions.
234 The service condition **Offshore** specifies a safety standard where high weather and seastate conditions can occur and where the vessel may be outside the range of search and rescue assistance in case of emergencies.

235 The service condition **Coastal** specifies a safety standard where very rough weather and seastate conditions can occur and where the vessel will be within the range of search and rescue assistance in case of emergencies.

236 The service condition **Inshore** specifies a safety standard where rough weather and seastate conditions can occur, but where the vessel normally does short voyages and has short distance to sheltered waters as for voyages close to the coastline, within archipelagos or large bays, lakes, rivers etc.

237 The service condition **Inland** specifies a safety standard where the sea is moderate and the vessel only operates inside sheltered waters, fjords, harbours, anchor places, inland waterways, on small lakes, rivers, channels etc.

238 The service condition **Sheltered waters** specifies a safety standard where the vessel only operates in sheltered waters where almost no waves occur and the speed at sea is restricted to avoid waves from other vessels.

240 **Ice conditions**

241 The main class notation **DNV** and the type and service notation, is given on condition that the vessel is not being used in areas with ice, e.g. in Arctic waters as defined by the International Load line convention as shown in figure at the end of this chapter.

242 It is further a condition that the vessel is not being used in fjords, lakes, or other waters, during the times of the year when these waters are covered by ice.

243 Vessels being used in waters with ice as defined above, are to be strengthened for ice loads according to the additional class notation **ICE**.

244 Vessels having the additional class notation **ICE**, can operate in waters with up to 40% ice concentration.

250 **Service conditions**

251 The various service conditions may be specified as follows for information:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Winter</th>
<th>Summer</th>
<th>Tropical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Offshore</td>
<td>50</td>
<td>100</td>
<td>250</td>
</tr>
<tr>
<td>Coastal</td>
<td>20</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Inshore</td>
<td>5</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Inland</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Sheltered</td>
<td>0,2</td>
<td>0,3</td>
<td>0,5</td>
</tr>
</tbody>
</table>

Note:
The seasonal tropical area as specified by the Load Line Convention is regarded as summer season with respect to service condition.

The definitions of seasons on the northern hemisphere are:
- Winter: 1 November - 31 March
- Summer: 1 April - 31 October

The definitions of seasons on the southern hemisphere are:
- Winter: 1 November - 31 March
- Summer: 1 April - 31 October

252 To simplify the understanding of the service conditions the various notations correspond to maximum seastates as defined by the World Meteorological Organisation (WMO) as follows:

<table>
<thead>
<tr>
<th>Service condition</th>
<th>Max. seastate</th>
<th>Maximum Hs (m)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean</td>
<td>&gt; 6</td>
<td>&gt; 6</td>
<td>Severe</td>
</tr>
<tr>
<td>Offshore</td>
<td>6</td>
<td>6</td>
<td>High</td>
</tr>
<tr>
<td>Coastal</td>
<td>5</td>
<td>4</td>
<td>Very rough</td>
</tr>
<tr>
<td>Inshore</td>
<td>4</td>
<td>2,5</td>
<td>Rough</td>
</tr>
<tr>
<td>Inland</td>
<td>3</td>
<td>1,25</td>
<td>Moderate</td>
</tr>
<tr>
<td>Sheltered</td>
<td>2</td>
<td>0,5</td>
<td>Slight</td>
</tr>
</tbody>
</table>

Hs is significant wave height with 10% probability of being exceeded.

253 National Authorities may impose geographical service restrictions overruling those conditions given on the certificate.

260 **Theoretical basis for seastate assessment**

261 The rules in this section are based on the assumption that vessels operating within certain service conditions will move to more sheltered waters when the wave height exceeds certain levels. The seastates for the various service conditions are based on the following wind strength assumptions:

<table>
<thead>
<tr>
<th>Load Line zone</th>
<th>Design wind condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter zone</td>
<td>BF 9 (strong gale), max. 24.5 m/s</td>
</tr>
<tr>
<td>Summer zone</td>
<td>BF 8 (fresh gale), max. 20.9 m/s</td>
</tr>
<tr>
<td>Tropical zone</td>
<td>BF 7 (moderate gale), max. 17.3 m/s</td>
</tr>
</tbody>
</table>

The geographical zones are in accordance with the International Load Line Convention, 1966.
262 A certain wind speed needs to blow a certain time and have a free fetch of water with a certain length to set up a certain significant waveheight. This correlation is shown in Figure 2.

![Figure 2: Time/distance/significant wave height diagram](image_url)

**Figure 2 Time/distance/significant wave height diagram**

**Note:**
When using this figure the seastate resulting from a specified wind speed will be limited by the fetch length or the blowing period. If neither fetch nor time is limiting, fully developed seastate will occur and another hindcast figure should be applied for wind speeds above approximately 15 m/s.

Significant waveheight $H_s$ is the average of the 1/3 highest waves in a seastate and is approximately equal to the estimated waveheight as observed and reported on weather forecast.

The maximum single waveheight may be twice the significant waveheight. Normally, the maximum single waveheight is to be taken 1,8 x $H_s$.

**End of note**

263 To develop the full significant waveheight, $H_s$, with the design wind speed as specified in 262, the following time is required:

<table>
<thead>
<tr>
<th>$H_s$ (m)</th>
<th>winter zone</th>
<th>summer zone</th>
<th>tropical zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 m</td>
<td>17 hours</td>
<td>never</td>
<td>never</td>
</tr>
<tr>
<td>6 m</td>
<td>10 hours</td>
<td>days</td>
<td>never</td>
</tr>
<tr>
<td>5 m</td>
<td>6 hours</td>
<td>14 hours</td>
<td>days</td>
</tr>
<tr>
<td>4 m</td>
<td>3 hours</td>
<td>6 hours</td>
<td>22 hours</td>
</tr>
<tr>
<td>3 m</td>
<td>100 minutes</td>
<td>2.5 hours</td>
<td>6 hours</td>
</tr>
<tr>
<td>2 m</td>
<td>40 minutes</td>
<td>1 hour</td>
<td>2 hours</td>
</tr>
<tr>
<td>1 m</td>
<td>10 minutes</td>
<td>15 minutes</td>
<td>30 minutes</td>
</tr>
<tr>
<td>0.5 m</td>
<td>4 minutes</td>
<td>6 minutes</td>
<td>8 minutes</td>
</tr>
</tbody>
</table>

264 To develop a full waveheight, $H_s$, with the design wind as specified in 262 the following fetch length or distance from land is required:

Note 1:
For information and guidance the present draft proposal for EU Directive for Passenger Ships has the following definitions of service restrictions.

**Ocean and Offshore** standard for passenger vessels should correspond with the safety level of draft Class A passenger ship for EU domestic service as follows:

"Class A" passenger ship means a passenger ship engaged on voyages of any kind other than international voyages and voyages covered by Classes B, C and D.

**Coastal** standard for passenger vessels should correspond with the safety level of draft Class B passenger ship for EU domestic service as follows:

"Class B" passenger ship means a passenger ship engaged on domestic voyages in the course of which it is at no time more than 20 miles from the line of coast, where shipwrecked passengers can land, corresponding to the medium tide height.

**Inshore** standard for passenger vessels should correspond with the safety level of draft Class C passenger ship for EU domestic service as follows:

"Class C" passenger ship means a passenger ship engaged on domestic voyages in areas where the probability of exceeding 2.5 m significant wave height is smaller than 10% over a one year period for all year round operation, or over a specific restricted period of the year for operation exclusively in such period (e.g. summer period operation) in the course of which it is at no time more than 15 miles from the line of coast, where shipwrecked passengers can land, corresponding to the medium tide height.

**Inland** standard of passenger vessels should correspond with the safety level of draft Class D passenger ship for EU domestic service as follows:

"Class D" passenger ship means a passenger ship engaged on domestic voyages in areas where the probability of exceeding 1.5 m significant wave height is smaller than 10% over a one year period for all year round operation, or over a specific restricted period of the year for operation exclusively in such period (e.g. summer period operation) in the course of which it is at no time more than 6 miles from the line of coast, where shipwrecked passengers can land, corresponding to the medium tide height.

**End of note 1**

Note 2:
For information and guidance about EU Directive for Recreational Craft:

The EU Directive for Recreational Craft specifies design categories referred to wind speed and wave heights which do not fully correspond with the service conditions of the class.
For recreational craft certified under the EU Directive Design Categories in accordance with the following will be applied. The EU Directive is a design standard and DNV involvement in the use of the boats is limited to those craft which are given a classification certificate for a period in service.

**Boat Design Categories:**

<table>
<thead>
<tr>
<th>Service conditions</th>
<th>Design category</th>
<th>Wind force (Beaufort scale)</th>
<th>Significant wave height (H 1/3 metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A - &quot;Ocean&quot;</td>
<td>exceeding 8</td>
<td>exceeding 4</td>
</tr>
<tr>
<td></td>
<td>B - &quot;Offshore&quot;</td>
<td>up to and including 8</td>
<td>up to and incl. 4</td>
</tr>
<tr>
<td></td>
<td>C - &quot;Inshore&quot;</td>
<td>up to and including 6</td>
<td>up to and incl. 2</td>
</tr>
<tr>
<td></td>
<td>D - &quot;Sheltered waters&quot;</td>
<td>up to and including 4</td>
<td>up to and incl. 0.5</td>
</tr>
</tbody>
</table>

**Definitions:**

A. **OCEAN:** Designed for extended voyages where conditions may exceed wind force 8 (Beaufort scale) and significant wave heights of 4 m and above, and vessels largely self-sufficient.

B. **OFFSHORE:** Designed for offshore voyages where conditions up to, and including, wind force 8 and significant wave heights up to, and including, 4 m may be experienced.

C. **INSHORE:** Designed for voyages in coastal waters, large bays, estuaries, lakes and rivers where conditions up to, and including, wind force 6 and significant wave heights up to, and including, 2 m may be experienced.

D. **SHELTERED WATERS:** Designed for voyages on small lakes, rivers, and canals where conditions up to, and including, wind force 4 and significant wave heights up to, and including, 0.5 m may be experienced.

The relationship between the various systems for service restrictions referred to seastate is as shown in the following table:

<table>
<thead>
<tr>
<th>Hs</th>
<th>Seastate</th>
<th>DNV</th>
<th>EU recr. craft</th>
<th>EU pass. ship</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2</td>
<td>Sheltered</td>
<td>Sheltered</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Inland</td>
<td>Class D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Inshore</td>
<td>Class C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Coastal</td>
<td>Offshore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Coastal</td>
<td>Class B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Offshore</td>
<td>Ocean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 6</td>
<td>Ocean</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

End of note 2

---

**300 Basic safety requirements**

**310 Safety principle**

The following principles are aimed at safety against hazard to the vessel, persons and environment and the performance of the main functions and their related auxiliary functions.

**312** By definition a vessel is a floating object able to transport safely itself and the cargo at sea. From this definition the basic safety principles to a vessel is established.

**313** Total safety can never be achieved, but the Rules aim at a level of safety commonly accepted for the type and service of the craft in question.

**314** The technical standard shall be such that the safety can be fulfilled during the whole class period of the certificate of the craft on condition that the vessel is properly handled and maintained.

**320 Main subjects**

321 The rules stipulate requirements to the craft with installations and equipment with respect to the following main subjects:

**322**
- Stability, freeboard and loading
- Watertight integrity and reserve buoyancy
- Weathertight appliances and drainage.

323
- Construction and scantlings of structures.

324
- Power supply
- Electrical plant and components.

325
- Propulsion plant
- Machinery and tank-piping systems and components.

326
- Steering gear and rudder
- Navigation and bridge arrangement
- Test procedures for sea trials.

327
- Fire safety.

328
- Safety of persons and lifesaving appliances
- Accommodation and ventilation.

---

**DEJ NORSKE VERITAS**
### Relevant classification parameters

To harmonise and simplify regulations and obtain recognition of certificates the following classification parameters for differentiation of requirements for craft intended for restricted service are used in the Rules.

**332 Requirements related to survival capability afloat**
- Weather or watertight integrity, freeboard, intact and damage stability is differentiated on basis of maximum seastate conditions alternatively on maximum number of persons in addition. Further differentiation is to be based on the speed of the craft if necessary.

**333 Requirements related to structural strength and capability to cope with water leakage** should be based on maximum seastate condition, alternatively on maximum speed of the craft in addition.

**334 Requirements related to electrical power supply including capability to start from dead ship and emergency power systems** should be based on maximum seastate condition alternatively the size of the craft.

**335 Requirements related to reliability of the propulsion capability and anchoring systems to use if this fails** should be based on maximum seastate condition alternatively the maximum speed of the craft or maximum number of persons onboard may be used.

**336 Requirements related to steering and navigation capability** should be based on the maximum speed of the craft alternatively the size of the craft.

**337 Requirements related to fire prevention and fire extinction** should be based on maximum distance away from place of refuge i.e. service restriction and conditions, alternatively maximum number of persons onboard.

**338 Requirements related to safety of persons onboard and lifesaving appliances** should be based on maximum distance away from place of refuge i.e. service restriction and condition, alternatively on maximum number of persons onboard.

<table>
<thead>
<tr>
<th>Basic safety requirements</th>
<th>Classification Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Size</td>
</tr>
<tr>
<td>1. Stability and watertight integrity</td>
<td>-</td>
</tr>
<tr>
<td>2. Structural strength and leakage bilge system</td>
<td>-</td>
</tr>
<tr>
<td>3. Electrical power supply, start and emergency power</td>
<td>2.</td>
</tr>
<tr>
<td>4. Propulsion system and anchoring arrangement</td>
<td>-</td>
</tr>
<tr>
<td>5. Steering and navigation capability</td>
<td>2.</td>
</tr>
<tr>
<td>7. Safety of persons onboard</td>
<td>-</td>
</tr>
</tbody>
</table>

The number indicates priority for the use of various classification parameters.

### Minimum size

**340 Minimum size**

The general requirements of the rules are given for vessels with the widest service condition, i.e. **Ocean**. Consequently, **Ocean** is not specified in tables with reduced requirements.

**342 Each of the service conditions has a minimum requirement to the size of vessel for the notation as follows:**

<table>
<thead>
<tr>
<th>Service Condition</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean</td>
<td>R1, minimum 9.0 m Lh</td>
</tr>
<tr>
<td>Offshore</td>
<td>R2, minimum 8.0 m Lh</td>
</tr>
<tr>
<td>Coastal</td>
<td>R3, minimum 7.0 m Lh</td>
</tr>
<tr>
<td>Inshore</td>
<td>R4, minimum 5.0 m Lh</td>
</tr>
<tr>
<td>Inland</td>
<td>R5, minimum 3.5 m Lh</td>
</tr>
<tr>
<td>Sheltered waters</td>
<td>R6, minimum 2.4 m Lh</td>
</tr>
</tbody>
</table>
PART 1 CHAPTER 1
CLASSIFICATION
DECEMBER 1997

CONTENTS

100 The classification system ........................................... 3
110 Application .......................................................... 3
120 Rules ..................................................................... 3
130 Rules objective ...................................................... 3
140 Entering into force .................................................... 3
150 Basis for assignment of class notation .......................... 3
160 Assumptions .......................................................... 3
170 Documentation ........................................................ 4
180 Disclosure of information ............................................ 4
190 Limitation of the Society's responsibility ......................... 4
200 Class notations .......................................................... 4
210 General ................................................................... 4
220 Main character of class ................................................. 4
230 Service and type notation ............................................. 5
240 Construction symbols ................................................ 5
250 Service condition notations ......................................... 5
260 Additional class notations ............................................ 6
270 Equipment and systems notations .................................. 6
280 CE notations ................................................................ 6
290 Register notations ...................................................... 6
300 Certification Procedure .................................................. 6
310 Certification ............................................................. 6
320 Classification Certificate ............................................... 7
330 Entry in the Society's Register ......................................... 7
340 Client's obligations ..................................................... 7
350 Suspension, withdrawal and cancellation of certificate ....... 7
400 Retention of class in service .......................................... 7
410 General ................................................................... 7
420 Periodical and renewal surveys ...................................... 8
430 Survey of damage ...................................................... 8
440 Survey of repairs ........................................................ 8
450 Conversions and alterations .......................................... 8
460 Change of ownership ................................................... 8
470 Conditions of Class and Memoranda ............................... 8
480 Validity of classification certificate in service .................... 8
490 Survey reports and survey status ................................... 9
500 Withdrawal of class in service ........................................ 9
510 General ................................................................... 9
520 Procedure ............................................................... 9
530 Reclassification in service ............................................. 9
540 Appeals .................................................................... 9
600 Liability and jurisdiction ............................................... 9
610 Limited liability ........................................................ 9
620 Governing law .......................................................... 10
630 Venue ..................................................................... 10
640 Appeals .................................................................... 10

TENTATIVE RULES FOR
CERTIFICATION AND
CLASSIFICATION OF
BOATS
GENERAL REGULATIONS

DET NORSKE VERITAS
Veritasveien 1, N-1322 Høvik, Norway Tel.: +47 67 57 99 00 Fax: +47 67 57 99 11
FOREWORD

Det Norske Veritas is a free-standing, autonomous and independent Foundation with the object of safeguarding life, property and the environment at sea and ashore.

Det Norske Veritas AS, a fully owned subsidiary Society of the Foundation, undertakes classification and certification and secures the quality of ships, mobile offshore units and fixed offshore installations, facilities and systems, and carries out research in connection with these functions. Moreover, the Society, provided its integrity is not impaired, may perform assignments which utilize its knowledge or which contribute to develop knowledge that will be required for the performance of these assignments.

The Foundation was established in 1978 as a direct continuation of the association The Norske Veritas which was established in 1864.

This new rule booklet was approved by the Board in August 1997.
The classification system

Application

This chapter describes the classification system with respect to application of class notations, certification modules for newbuildings, class entry and retention of class in the operating phase.

Rules

The Rules are to be understood as all those Rule requirements accepted by the Board which are developed by the Society or adopted from relevant International Maritime Standards, EU Directives or Sectorial Group Guidelines or ISO or CEN standards. Interpretations of International Maritime Standards and standards for vessels outside the scope of International Maritime Standards, appropriate, such as ISO or CEN standards, are included as decided by the Society.

For recreational craft the Society is free to decide appropriate requirements as far as no international legislation is applicable for the vessel. Requirements taken from EU Directives are printed in italics.

International Maritime Standards mean international IMO/ILO conventions, protocols, codes and resolutions, in so far as their purpose is safety and pollution prevention, excluding articles and regulations dealing with intergovernmental relations, legal and formal aspects.

EU Directives and ISO/CEN Standards are to some extent used as basis for these Rules and taken into consideration as specified in each chapter.

Tentative Rules are Rules applying to new fields to which the Society reserves the right to make adjustments during a period in order to obtain the intention reflected in the Rules.

A Guidance note given in the Rules is advice which is not mandatory for assignment of class notation on the certificate, but with which the Society, in light of general experience, advises compliance, hence, it is for the client to decide whether to apply the Note or not.

Rules objective

The Classification system comprises the development of independent technical standards, continuously revised and amended based on the service experience gained by worldwide activity.

The Rules are aimed at ensuring safety against hazards to the vessel, personnel, passengers and cargo, and against hazards to the environment as a consequence of the vessel.

The classification is performed in accordance with the requirements of the Rules and any other standards to which reference is made.

The society issues a certificate with assigned class notation. The main particulars and class notations for the vessel is listed in Registers published by the Society.

Entering into force

Rules and amendments accepted by the Board will come into force when decided by the Board, normally six (6) months after acceptance.

Entry into force and application of those parts of the Rules covering Standards developed outside the Society are indicated at the beginning of each of the relevant Rule chapters.

The Rules which are in force at the date of the written request for certification, are the basis for the assignment and maintenance of the class notation.

In exceptional cases, where unacceptable service experience and/or theoretical findings clearly show that safety hazards may arise in connection with items covered by the existing Rules, the Society may lay down supplementary requirements concerning the assignment and retention of the class notation to maintain the overall safety standard reflected by the Rules.

The Society will consider alternatives found to represent an overall safety standard equivalent to that of the Rules. Equivalent alternatives are to be identified.

If disputes should arise in connection with the application of those parts of the Rules which are adopted from any other Standards, the texts of the Rules are to prevail.

Basis for assignment of class notation

Having assigned a specific class notation implies that the Society has been satisfied that the vessel meets the Rule requirements for the particular class notation.

Assumptions

Certification is based on the following assumptions about maintenance and handling:

- Maintenance of the vessel:
  The vessel, machinery installations and equipment are to be sufficiently maintained.
- Handling of the vessel:
  The vessel, machinery installations and equipment are to be adequately manned and competently handled. This includes also stowage of cargo, distribution of ballast and bunkers, and speed and navigation in heavy weather.
- Compliance with restrictions:
  Conditions given on the certificate regarding the use of the vessel are to be complied with, in particular with respect to maximum persons, load, power, speed etc., and the service restrictions given.
170 Documentation

171 All information which may influence the judgement, decisions and requirements of the Society for the purpose of certification, is to be made available to the Society. It is the client's responsibility to ensure that such information is brought to the attention of the Society in a timely manner. Information may be made available by submitting documents to the Society or by surveys performed at the clients' premises, the vessel or the premises of the client's subcontractors.

172 Documents for information or approval required in each chapter of the Rules are to be submitted to the Society.

173 The documentation forming the basis for certification is, at all times, to reflect the true conditions. Revisions of documents are therefore to be submitted to the Society to the extent such revisions may influence decisions and requirements of the Society.

180 Disclosure of information

181 The Society will not disclose technical information, drawings and survey reports to any person other than the owners or those having been given authority to receive information by legislation, court decision or written declaration by the owners. The Society will not, unless requested by legislation or court decision, disclose information which can be considered as the property of another party except when their permission is given in writing. Calculations performed by the Society in connection with approval work will not be disclosed to any third party.

182 The Society may, insofar as the information is related to its activity in providing and maintaining the certification of a vessel, upon request disclose such information to authorised representatives of the National Authorities of the vessel's country of registry.

190 Limitation of the Society's responsibility

191 The certification service is performed on the basis assumption that other parties involved (building yard, designers, manufacturers, sub-contractors, ship owners, etc.) fulfil their individual obligations. The certification service is not performed in substitution of other parties' role or obligations. Nothing contained herein or in any certificate, report or document issued in connection with or pursuant to these rules, shall relieve any designer, engineer, builder, manufacturer, shipyard, seller, supplier, owner, operator or other parties from any obligations or consequences of default whatsoever. In particular, compliance with the Rules does not imply acceptance or commissioning of a ship. This is the exclusive responsibility of the owner.

192 Any document issued by the Society in relation to surveys performed reflects the condition of the vessel at the time of survey. It is the responsibility of the owner to maintain the condition of the vessel as required by the Rules between surveys.

200 Class notations

210 General

211 The classification system is based on the principle that a specific class notation represents a defined technical standard of a vessel. By a combination of various class notations the safety standard of the vessel will be determined.

212 Adequate requirements of a class notation are developed on basis of service experience with classed vessels documented through survey reports and safety statistics from insurance companies, maritime authorities and the Society. The requirements aim at establishing an acceptable risk level for a vessel complying with all relevant class notations applicable for the vessel in question.

213 Some class notations are mandatory for issuance of a certificate, others are optional. The mandatory class notations represent the minimum safety standard acceptable to the Society and the optional class notations represent additional safety standards.

214 The assigned class notations are given on Module Certificates as well as Classification Certificates.

215 The Module Certificate verifies the compliance with the requirements at the date of the certificate, but does not contain any commitment by the owner to maintain the standard while in service.

216 The classification certificate has a validity of maximum 5 years as the owner has committed himself to have the vessel under periodical survey. If any of the assigned class notations have a shorter validity, the certificate will have the validity of the shortest.

220 Main character of class

221 The class notation DNV states that the requirements of the main class notation are complied with. The main character of class, DNV, is mandatory to issue a certificate.

Guidance note:
The DNV class notation is different from the 1A1 notation used by the Society for Ships, High Speed and Light Craft and Offshore Units.

End of Guidance note

222 The Rules for main class notation, DNV, stipulate requirements to the hull, machinery installations and equipment with respect to strength and performance of the following main functions:
- weathertight and watertight integrity
- freeboard, stability, survival capability
- structural strength
- power supply
- propulsion
- steering
- fire safety
- drainage and bilge pumping
- anchoring and mooring.
223 The requirements are aimed at safety against hazards to the vessel, personnel and environment and reliability in the performance of the above main functions and their related auxiliary functions.

224 For certain machinery installations, regardless of their contribution to the main functions, separate requirements may be applied. Such installations comprise:

- electric power plant with more than 50 V
- gravity tanks or pressure vessels and associated piping systems for:
  - toxic fluids,
  - fluids with temperature above 220°C
- boilers and steam piping systems,
- pressure vessels and associated piping systems for compressed gases where:
  \[ pV \geq 150 \text{kNm} \]
  \[ p = \text{design pressure in kN/m}^2 \]
  \[ V = \text{pressure vessel volume in m}^3 \]
- firing and combustion installations.

230 Service and type notation

231 A service and type notation is mandatory to issue a certificate. The notation states the basic type of service for the use of the vessel.

232 Only one (1) service and type notation will be given on the certificate.

233 The following service and type notations may be applicable for recreational craft:

Recreational Craft (for certification)

Yacht (for classification)

Guidance note:
The following notations may be used for other service and type:

Lifeboat
Barge
Tug
Cargo
Fisher
Passenger

End of Guidance note

234 A specific service and type notation may include a number of alternative types i.e. the notation Fisher may include types as trawlers, seiners, liners etc.

235 A main class notation with service and type notation may be as follows when assigned on a Module Certificate:

DNV Recreational Craft.

236 On a Classification certificate with commitment by the owner for maintenance and periodical surveys, the same type of craft as in 235 will be assigned the following class notation:

DNV Yacht.

240 Construction symbols

241 The construction symbol * will be given to vessels certified under the following modules:

B + F *)

G

*) On the condition that Pt. I Ch.2 430 is applied.

242 The construction symbol ° will be given to vessels built under the supervision of a recognised classification society and later assigned class with DNV based on the class entry procedures in Pt. I Ch. 3. Vessels not built under supervision of a recognised classification society and later assigned class with DNV according to the above procedures will not be given a construction symbol.

243 The symbol (?) will be given to vessels certified under modules B + D. Module B alone does not justify a construction symbol on the certificate.

244 The construction symbol will be given in front of the main character of class as in the following example:

* DNV Yacht or

(°) DNV Recreational Craft

250 Service condition notations

251 All vessels are to be assigned one of the following service conditions:

Ocean
Offshore
Coastal
Inshore
Inland
Sheltered Waters.
Guidance note:
The notation *Sheltered Waters* will only be used for Module Certification of Recreational Craft and specify very strict conditions.

End of guidance note

252 Each of the specific service conditions represent a maximum design seastate and wind condition as specified by Pt.0 Ch.3.

Guidance note:
Maritime Authorities or Port States may have geographical service area limitations which are not reflected in these rules. A vessel can be evaluated for a geographical service limitation based on the above service conditions.

End of Guidance note

253 The service condition notation will be specified in the class notation as follows:

**DNV Offshore Yacht** or

**DNV Coastal Recreational Craft**

254 Vessels shall not operate in arctic waters or any other waters where ice may occur, unless the vessel is strengthened and arranged for operation in ice and is assigned a class notation for ice conditions.

260 Additional class notations

261 The additional class notations are optional and represent an additional safety standard for the vessel.

262 The additional class notation will be specified after the service and type notation for the vessel as in the following example:

**DNV Offshore Recreational Craft, SL**

for additional safety on Stability and Loadline.

263 The additional class notations are given in Pt. 5 of the Rules.

270 Equipment and systems notations

271 Vessels having special equipment or systems found to satisfy relevant requirements in Pt.6 will be given a corresponding equipment class notation.

272 The equipment notations are optional and will be specified after the additional class notations as in the following example:

**DNV Offshore Recreational Craft, SL, Sr**

for Sail Rig equipment.

280 CE notations

281 The Society is appointed Notified Body, under EU New Approach legislation, to carry out conformity assessment for certain EU Directives. The requirements of these Directives are included in the requirements for the relevant type and service notations.

282 Vessels certified according to the following modules, including the special requirements for CE marking:

B + D

B + F

G

and with a type and service notation which include the requirements of an EU Directive will be given the notation:

**CE**

as an addition to the type and service notation.

283 Upon agreement between the Society and the manufacturer a higher module than specified in the directive may be applied for certification. In that case general third party Certificates/Declarations will be issued and the manufacturer will affix the CE mark with reference to the module prescribed by the directive.

290 Register notations

291 Register notations provide information regarding special features of the vessel. The notations may be entered in the Register, but the corresponding features will be subject to surveys only to the extent covered by the vessel's class notations.

292 Register notations will not be specified on the class certificate.

300 Certification Procedure

310 Certification

311 A request for certification of a vessel or a series of boats is to be submitted in writing by the client.

312 Before any assessments are to be carried out by the Society, a detailed scope of work is to be agreed by the client with respect to the various class notations which shall be basis for the work carried out by the Society.

313 A request for specific class notations is in no way to be understood as a commitment by the Society to assign the requested notations. Only those notations with which the vessel complies will be assigned.

314 A class notation will always be given on a certificate. The certificare is to be issued in accordance with one or more of the certification modules specified in Pt.1 Ch.2.

315 Materials and components to be used or installed onboard a vessel will have to be certified as required for the various class notations of the rules.
320 Classification Certificate

321 For vessels with the construction symbol @ in the class notation on the Module Certificate, a Classification Certificate for the operating phase may be issued on request from the owner or from the owner through the yard.

322 If the Classification Certificate is requested later than six months after the date of issue of the Module Certificate, a survey may be required to verify that the technical standard of the vessel is maintained.

323 In case of classification of an existing vessel not built under the supervision of the Society, or classification of an existing vessel previously classed by the Society, the Classification Certificate may be issued according to the class entry procedures of Pt. I Ch. 3.

330 Entry in the Society's Register

331 When a vessel or a type of vessel has been assigned a class notation, its main particulars and class notations will be entered in one of the Society's registers.

332 For individual vessels built under the supervision of the Society, the class in service is entered with a statement of the year and month from which the periodical surveys will be dated. For other vessels a notation is made of the year and month of completion of the survey for the assigned class in service.

340 Client's obligations

341 The applicant or certificate holder agrees that:

- the Society will have unobstructed access without prior notification to the production site covered by the service during the normal working hours. All facilities and qualified staff necessary for adequate surveillance are to be provided.

- the products for which a Type Examination Certificate/Type Approval Certificate may be issued, are to be produced to the same specifications using the same tools as the sample for which successful type tests were carried out.

- for products granted Type Examination Certificate/Type Approval Certificate, the Society is to be informed about any modifications of the product, manufacturing process or quality system which may affect the characteristics of the product. The Society determines whether the changes require further testing and/or inspection or other investigations.

- manufacturing and service data statistics are to be kept by the manufacturer and made available to the society on request.

350 Suspension, withdrawal and cancellation of certificate

351 A certificate which is valid for a period of time, such as a Type Examination/Type Approval/Quality System Certificate, may be suspended for a limited period of time for the following reasons:

a) If a non-conformity with the requirements is found such as a nature that immediate withdrawal is not found necessary.

b) If a minor non-conformity with the requirements is found and corrective actions are not taken within the time decided by the Society.

c) In case of improper use of the documents or the product marking is identified and not rectified by suitable retractions and appropriate remedial measures by the certificate holder.

A suspension will be formally confirmed by the Society in writing. The Society shall specify conditions and requirements for the abolishment of the suspension.

352 A certificate may be withdrawn or cancelled if:

- audits or certificate retention surveys reveal non-conformities of a serious nature which are not corrected within a period of time decided by the Society.

- client fails to comply with due settlements of his financial obligations.

- inadequate measures are taken by the certificate holder in case of suspension of certificate.

- there has been any other serious contravention to the requirements of the Certification Services or the procedures of the Society.

- the certificate holder does not wish to prolong the validity of his certificate.

- the regulations, codes, rules, standards, specifications, etc. which are the basis for the certification, are amended and the certificate holder either will not or cannot ensure conformity with the new requirements.

A withdrawal/cancellation will be formally confirmed by the Society in writing. The Society shall specify conditions and requirements for the abolishment of the withdrawal/cancellation.

400 Retention of class in service

410 General

411 In order to retain a vessel's class in service with the Society, the owner is to:

submit complete and correct information on the vessel and its use, which would be of significance to the Society for its assessment of the condition of the vessel in relation to the Rules;

- subject the vessel to prescribed periodical and renewal surveys, surveys of damage, repairs, conversions and alterations;

- subject the vessel to unscheduled surveys when deemed necessary by the Society;
– carry out Conditions of Class in service specified by the Society in accordance with the Rules within the given time limit;
– pay all due fees and expenses.

412 It is the duty of the owner to request surveys from the Society and to provide the assistance and safe access required to the extent necessary for completion of the surveys in accordance with the Rules.

420 Periodical and renewal surveys

421 A vessel is to be subjected to surveys with frequency and extent stipulated in Pt. I Ch. 3.

422 Annual surveys, covered by the Rules, which are carried out by National Authorities of the flag state may be accepted as basis for the retention of the class in service.

430 Survey of damage

431 If the hull, machinery installations or equipment covered by classification sustain damage of such extent that it may be presumed to lead to a Condition of Class in service the Society is to be informed without delay. The vessel is to be surveyed in the first port of call or according to further instructions from the Society. The survey is to be of the extent which the surveyor considers necessary for ascertaining the amount of damage. Otherwise the certificate is not valid.

440 Survey of repairs

441 When hull, machinery installations or equipment which are covered by any class notation on a valid certificate in service are to be subjected to repairs of any significance, the work is to be carried out under supervision of the surveyor, according to the applicable Rules or a completion survey of the relevant aspects is to be carried out.

450 Conversions and alterations

451 If hull, machinery installations, equipment or systems covered by any class notation on a valid certificate in service are to be converted or altered, the changes are to be documented and are to be approved by the Society in advance or surveyed as completed.

460 Change of ownership

461 A vessel with notation DNV does not retain classification certificate in service when transferred to another owner. In the case of such transfer the previous owner is to give the Society a written notice immediately. Until this has been done, communication with binding effect will be sent to the previous owner.

470 Conditions of Class and Memoranda

471 If it is found that Rule requirements implied are not satisfied, the Society will issue a Condition of Class on any improvements, new surveys or other measures found necessary in order to retain the class with the Society, regardless of whether the matter referred to has previously been approved.

472 Conditions of Class constitute requests by the Society in order to ensure compliance with the Rules. They are not to be considered as advice.

473 If the Society deems it necessary to have technical measurements or other examinations carried out to ascertain whether damage has been sustained or is imminent, a Condition of Class hereon will be issued.

474 Conditions of Class and Memoranda are defined as follows:

– Conditions of Class to be carried out, abbreviated CC, are requirements to the effect that specified operations (e.g. repairs, adjustments, reinforcements or surveys) are to be carried out within a specified time limit (if necessary immediately)
– Memoranda for Owners, abbreviated MO, are information to the owners, and may be additional to the class related information contained in the Operating Manual, exemptions from Rule requirements, minor damage considered of no importance to the vessel’s safety, etc.
– Memoranda for Owners will not require repairs or surveys to be carried out.

Guidance note:

Conditions covering requirements outside the scope of classification issued by, or on behalf of, National Authorities, will be abbreviated CA.

End of Guidance note

475 CC and MO are sent in writing to the owners. CC for immediate repairs can be made verbally, provided the representative of the owners accepts the CC and the surveyor ensures that the CC has been carried out before the ship leaves port.

476 The Society may at any time alter a CC or MO if this is considered necessary.

477 A written CC or MO will be deleted when by survey or other means the Society has established that the requirements have been fulfilled. A verbal CC is revoked when a subsequent survey proves that the repair is satisfactory.

480 Validity of classification certificate in service

481 When the renewal surveys for hull, machinery installations and equipment have been completed, and the surveyor is satisfied that the requirements corresponding to the class notation assigned have been met, the retention of class notation will be confirmed by the issuance of a new classification certificate in service.

482 For renewal surveys completed within 3 months before the expiry date of the existing certificate, the new certificate
will be valid to a date not exceeding 5 years from the expiry date of the existing certificate.

483 For renewal surveys completed after the expiry date of the existing certificate, the new certificate will be valid to a date not exceeding 5 years from the expiry date of the existing certificate.

484 For renewal surveys completed more than 3 months before the expiry date of the existing certificate, the new certificate will be valid to a date not exceeding 5 years from the completion date of the renewal survey.

485 In cases where postponement has been granted, the new certificate will be valid to a date not exceeding 5 years from the expiry date of the existing certificate before postponement was granted.

486 In cases where the renewal surveys are carried out concurrently with major conversions and/or alterations requiring a long conversion time, the validity of the new certificate will normally be 5 years from the date of the completion and/or alteration.

490 Survey reports and survey status

491 The surveyor will prepare and submit to the owner reports on all surveys which have been carried out and issue Conditions of Class and Memoranda, when relevant.

500 Withdrawal of class in service

510 General

511 The Society may withdraw a vessel's class certificate in service in cases where the assumptions regarding the maintenance and handling of the vessel, or the provisions for retention of class, have been breached.

Withdrawal of class certificate in service may take effect immediately or after a specified period of time.

512 If the renewal surveys for hull, machinery installations and equipment related to main character of class notation are not carried out before expiry date of the classification certificate in service and if no postponement has been granted on the certificate, the class certificate in service is not valid.

513 If the outstanding debt owed to the Society is not paid within a fixed date, the Society may withdraw the vessel's class certificate in service with one month's written notice. This also applied when the obligation to pay rests with a yard. In special cases a shorter notice may be given.

514 The withdrawal of the classification certificate in service may be made conditional in that it will only come into effect if the owners have not rectified the conditions leading to the withdrawal within a stipulated time.

515 If the Owners' default only affects conditions related to special class notations, the withdrawal may be limited to these notations only.

520 Procedure

521 The decision to withdraw a vessel's certificate in service before the date of expiry is made by the Administration of the Society.

522 The decision of the Society is forwarded in writing to the owners.

523 Where a withdrawal of class certificate in service before the date of expiry has come into effect, the Society will:
- notify the proper authorities in the country where the vessel is registered
- make an entry of it in the Register
- make the information available to underwriters.

530 Reclassification in service

531 If the circumstances leading to withdrawal of the class certificate in service before the date of expiry no longer exist, the Society may upon request reinstate the vessel's class certificate in service. As a condition hereto, the Society may require that the vessel be subjected to a survey or certain specified improvements.

540 Appeals

541 The client may request that a decision by the Society is to be taken up for reconsideration by one or more surveyors specially appointed by the Society. The expenses incurred are to be paid by the party making the appeal, however, if the earlier decision is revoked, the expenses will be covered by the Society.

600 Liability and jurisdiction

610 Limited liability

611 It is agreed that save as provided below the Society, its subsidiaries, bodies, officers, directors, employees and agents shall have no liability for any loss, damage or expense allegedly caused directly or indirectly by their mistake or negligence, breach of warranty, or any other act, omission or error by them, including gross negligence or wilful misconduct by any such person with the exception of gross negligence or wilful misconduct by the governing bodies or senior executive officers of the Society. This applies regardless of whether the loss, damage or expense has affected anyone with whom the Society has a contract or a third party who has acted or relied on decisions made or information given by or on behalf of the Society.

612 However, if any person uses the services of the Society or its subsidiaries or relies on any decision made or information given or on behalf of them and in consequence suffers a loss, damage or expense proved to be due to their negligence, omission or default, then the Society will pay by way of compensation to such person a sum representing his proved loss.
In the event the Society or its subsidiaries may be held liable in accordance with the sections above, the amount of compensation shall under no circumstances exceed the amount of the fee, if any, charged for that particular service, decision, advice or information.

Under no circumstances whatsoever shall the individual or individuals who have personally caused the loss, damage or expense be held liable.

In the event that any provision in this section shall be invalid under the law of any jurisdiction, the validity of the remaining provisions shall not in any way be affected.

These Rules, the certification and classification of the vessel or unit and the relationship between the Society and other parties shall be governed by Norwegian law.

Any dispute arising in relation to or as a consequence of these Rules shall only be resolved by the courts of Norway, the Municipal Court of Oslo being the proper venue.

Where the Society has performed its services as notified body, the requirements in the Norwegian Public Administration Act of 10 February 1967, will apply. In said cases the client may lodge appeals to the Society within 3 weeks after the relevant decision became known to the client. If the decision is not reversed by the Society, the appeal will be forwarded to the relevant Norwegian Authority.
PART 1 CHAPTER 2

CERTIFICATION OF NEWBUILDINGS

DECEMBER 1997

CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>General</td>
<td>3</td>
</tr>
<tr>
<td>110</td>
<td>Application</td>
<td>3</td>
</tr>
<tr>
<td>120</td>
<td>Certification</td>
<td>3</td>
</tr>
<tr>
<td>130</td>
<td>Certificates</td>
<td>3</td>
</tr>
<tr>
<td>140</td>
<td>Notations</td>
<td>3</td>
</tr>
<tr>
<td>200</td>
<td>Type Approval</td>
<td>3</td>
</tr>
<tr>
<td>210</td>
<td>General</td>
<td>3</td>
</tr>
<tr>
<td>220</td>
<td>Scope</td>
<td>3</td>
</tr>
<tr>
<td>230</td>
<td>Request</td>
<td>4</td>
</tr>
<tr>
<td>240</td>
<td>Documentation</td>
<td>4</td>
</tr>
<tr>
<td>250</td>
<td>Examination and Testing</td>
<td>4</td>
</tr>
<tr>
<td>260</td>
<td>Certificate</td>
<td>4</td>
</tr>
<tr>
<td>270</td>
<td>Requirements for CE marking</td>
<td>4</td>
</tr>
<tr>
<td>300</td>
<td>Production Certification</td>
<td>5</td>
</tr>
<tr>
<td>310</td>
<td>General</td>
<td>5</td>
</tr>
<tr>
<td>320</td>
<td>Scope</td>
<td>5</td>
</tr>
<tr>
<td>330</td>
<td>Quality system</td>
<td>5</td>
</tr>
<tr>
<td>340</td>
<td>Approval Audit</td>
<td>5</td>
</tr>
<tr>
<td>350</td>
<td>Modifications</td>
<td>5</td>
</tr>
<tr>
<td>360</td>
<td>Periodical Audit</td>
<td>6</td>
</tr>
<tr>
<td>370</td>
<td>Requirements for CE marking</td>
<td>6</td>
</tr>
<tr>
<td>380</td>
<td>Production Certificate</td>
<td>6</td>
</tr>
<tr>
<td>400</td>
<td>Product Certification</td>
<td>6</td>
</tr>
<tr>
<td>410</td>
<td>General</td>
<td>6</td>
</tr>
<tr>
<td>420</td>
<td>Scope</td>
<td>6</td>
</tr>
<tr>
<td>430</td>
<td>Survey</td>
<td>6</td>
</tr>
<tr>
<td>440</td>
<td>Statistical verification</td>
<td>6</td>
</tr>
<tr>
<td>450</td>
<td>Requirements for CE marking</td>
<td>7</td>
</tr>
<tr>
<td>460</td>
<td>Product Certificate</td>
<td>7</td>
</tr>
<tr>
<td>500</td>
<td>Unit Certification</td>
<td>7</td>
</tr>
<tr>
<td>510</td>
<td>General</td>
<td>7</td>
</tr>
<tr>
<td>520</td>
<td>Scope</td>
<td>7</td>
</tr>
<tr>
<td>530</td>
<td>Documentation</td>
<td>7</td>
</tr>
<tr>
<td>540</td>
<td>Unit Certificate</td>
<td>7</td>
</tr>
<tr>
<td>550</td>
<td>Requirements for CE marking</td>
<td>7</td>
</tr>
</tbody>
</table>

DET NORSKE VERITAS
Veritasveien 1, N-1322 Høvik, Norway Tel.: +47 67 57 99 00 Fax: +47 67 57 99 11
FOREWORD

Det Norske Veritas is a free-standing, autonomous and independent Foundation with the object of safeguarding life, property and the environment at sea and ashore.

Det Norske Veritas AS, a fully owned subsidiary Society of the Foundation, undertakes classification and certification and secures the quality of ships, mobile offshore units and fixed offshore installations, facilities and systems, and carries out research in connection with these functions. Moreover, the Society, provided its integrity is not impaired, may perform assignments which utilize its knowledge or which contribute to develop knowledge that will be required for the performance of these assignments.

The Foundation was established in 1978 as a direct continuation of the association The Norske Veritas which was established in 1864.

This new rule booklet was approved by the Board in August 1997.
General

Application

This chapter is applicable to Module Certification of recreational craft and, to the extent required by the various rule chapters, materials and components to such vessels.

Within the Classification System Module Certification is applied to verify conformity with the rule requirements in the design and construction phase.

The Module Certification system for recreational craft is based on the EU certification modules adopted under the New Approach legislation for conformity assessment.

When the special requirements for CE marking, as specified under each module, is applied, the Certification Modules applied by the Society are in full compliance with the EU modules and appropriate for Notified Body certification.

When the Society is not acting as a Notified Body, the special requirements for CE marking will not be applied.

This chapter describes the various certification modules and thereby the scope of work to be applied to verify compliance with the Rule requirements for issuance of Module Certificates.

Certification

Certification is to verify compliance with the requirements of the Rules applicable to a specific object, a vessel, a component or a material.

Certification is documented by a certificate for the object(s) stating the certification procedure applied, the conditions, restrictions and when relevant the validity of the certificate.

The following table specifies the various Certification Modules and the corresponding EU module combinations:

<table>
<thead>
<tr>
<th>DNV Certification Modules</th>
<th>EU Certification Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type Approval</td>
<td>B: Type Examination</td>
</tr>
<tr>
<td>Production Certification</td>
<td>D: Production Quality Assurance + B</td>
</tr>
<tr>
<td>Product Certification</td>
<td>F: Product Verification + B</td>
</tr>
<tr>
<td>Unit Certification</td>
<td>G: Unit Verification</td>
</tr>
</tbody>
</table>

Type Examination Certificate may be issued as an alternative to Type Approval Certificate when so required by the EU Directive.

Certificates

The following Module certificates can be issued by the Society in accordance with the Module Certification system and established certification practice within the classification system.

Type Approval Certificate can be issued on basis of module B as given in 200.

**Guidance note:**
This certificate is comparable with the Type Approval Certificates for materials and components within the conventional classification system applied by the Society.

End of Guidance note

Production Certificate can be issued on basis of module B and D as given in 200 and 300.

**Guidance note:**
This certificate is comparable with Type Certificate previously issued on basis of Nordic Boat Standard and DNV Rules for Certification of Leisure Boats and DNV Rules for Lifeboats.

End of Guidance note

Product Certificate can be issued on basis of module B and F as given in 200 and 400.

**Guidance note:**
This certificate is similar to the Boat Certificates previously issued on basis of Nordic Boat Standard and DNV Rules for Certification of Leisure Boats and DNV Rules for Lifeboats with respect to certification of individual boats.

End of Guidance note

Unit Certificate can be issued on basis of module G as given in 500.

**Guidance note:**
This certificate is similar to the Product Certificate, see 134 above, except that it is based on a case by case approval.

End of Guidance note

Notations

All certificates will be assigned notations as given in Pt. I Ch. I of these Rules.

Type Approval

General

The content of this text corresponds with the Module B, Type Examination. EU module text is in italic letters.

To correspond with the terminology of the classification system the wording of the text is in some places modified without changing the content of the certification module.

The Society is the certification body.

Type Approvals will be listed and published.

Scope

The Society accords and attests that a specimen, representative of the production envisaged, meets the provisions of the Rules that apply to it.
230 Request

231 The request for the Type Approval shall be lodged by the manufacturer or his authorized representative to the Society.

232 The request shall include:
- the name and address of the manufacturer and, if the request is lodged by the authorized representative, his name and address in addition;
- a written declaration that the same request has not been lodged with any other notified certification body. Copy of other relevant certification shall be enclosed;
- the technical documentation, as described in 243.

240 Documentation

241 The applicant requesting Type Approval shall place at the disposal of the Society a specimen of the product and a technical documentation of the product, representative of the production envisaged and hereinafter called "type". A type may cover several versions of the product provided that the differences between the versions do not affect the level of safety and the other requirements concerning the performance of the product.

242 The Society may request further specimens of the product and documentation of the product if needed for carrying out the test programme.

Guidance note:
The text above "shall place at the disposal of the Society a specimen" means that a specimen of the product shall be available, but not be submitted to the Society.

End of Guidance note

243 The technical documentation shall enable the conformity of the product with the requirements of the Rules to be assessed. It shall, as far as relevant for such assessment, cover the design, manufacture and functioning of the product.

244 To ensure that the technical documentation is in compliance with the rules, approval of the documentation is required.

250 Examination and Testing

251 The Society will examine the technical documentation, verify that the type has been manufactured in conformity with the technical documentation and identify the elements which have been designed in accordance with the relevant provisions of the Rules as well as the components which have been designed without applying the relevant provisions of the Rules.

252 To verify that the type has been manufactured in conformity with the Rules, survey of the type is to be carried out.

253 The Society will perform or have performed the appropriate examinations and necessary tests to check whether, where the Rules have not been applied, the solutions adopted by the manufacturer meet the Essential Requirements of the applicable EU Directive.

254 The Society will perform or have performed the appropriate examinations and necessary tests to check whether, where the manufacturer has chosen to apply the relevant Rules, these have actually been applied.

255 The Society will agree with the applicant the location where the examinations and necessary tests shall be carried out.

260 Certificate

261 Where the type meets the provisions of the Rules, the Society shall issue a Type Approval or a Type Examination certificate to the applicant. The certificate shall contain the name and address of the manufacturer, conclusions of the examination, conditions for its validity and the necessary data for identification of the approved type.

262 A list of the relevant parts of the technical documentation shall be annexed to the certificate and a copy kept by the Society.

263 If the manufacturer is denied a Type Approval or a Type Examination certification, the Society shall provide detailed reasons for such denial.

264 The applicant shall inform the Society of all modifications to the approved product which must receive additional approval where such changes may affect the conformity with the Rule requirement or the prescribed conditions for use of the product.

This additional approval is given in the form of an addition to the original Type Approval certificate.

270 Requirements for CE marking

271 The Society shall communicate to the other notified bodies the relevant information concerning the Type Approval or Type Examination certificates and additions issued and withdrawn.

272 The other notified bodies may receive copies of the certificates and/or their additions. The annexes to the certificates shall be kept at the disposal of other certification bodies.

273 The manufacturer or his authorized representative shall keep with the technical documentation copies of the certificates and their additions for a period ending at least ten years after the last product has been manufactured.

274 Where neither the manufacturer nor his authorized representative is established within the Community, the obligation to keep the technical documentation available shall be the responsibility of the person who places the product on the market.
300 Production Certification

310 General

311 The content of this text corresponds with the Module D, Production Quality Assurance. It is a condition that the product is Type Approved or Type Examined in accordance with 200 to obtain a Production Certificate. EU module text is given in italics.

312 To correspond with the terminology of the classification system the wording of the text is in some places modified without changing the content of the certification module D.

313 The Society is the certification body.

320 Scope

321 The manufacturer shall satisfy the obligations of point 324, ensure and declare that the products concerned are in conformity with the type as described in the Type Approval or Type Examination certificate and satisfy the requirements of the Rules that apply to them.

322 The manufacturer shall affix the certification signboard to each product and draw up a written declaration of conformity.

323 The certification signboard shall be accompanied by the distinguishing number of the Society.

324 The manufacturer shall operate an approved quality system for production, final product inspection and testing as specified in paragraph 330 and shall be subject to monitoring as specified in point 360.

330 Quality System

331 The manufacturer shall lodge an application for assessment of his quality systems with the Society, for the products concerned.

332 The application shall include:

- all relevant information for the product category envisaged;
- the documentation concerning the quality system;
- the technical documentation of the approved type and a copy to the Type Approval or Type Examination certificate.

333 The quality system shall ensure compliance of the products with the type as described in the Type Approval or Type Examination certificate and with the requirements of the Rules that apply to them.

334 All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic and orderly manner in the form of written policies, procedures and instructions. The quality system documentation must permit a consistent interpretation of the quality programmes, plan, manuals and records.

335 It shall contain in particular an adequate description of:

- the quality objectives and the organizational structure, responsibilities and powers of the management with regard to product quality;
- the manufacturing, quality control and quality assurance techniques, processes and systematic actions that will be used;
- the examinations and tests that will be carried out before, during and after manufacture, and the frequency with which they will be carried out;
- the quality records, such as inspection reports and test data, calibration data, qualification reports of the personnel concerned, etc.;
- the means to monitor the achievement of the required product quality and the effective operation of the quality system.

340 Approval Audit

341 The Society shall assess the quality system to determine whether it satisfies the requirements referred to in point 333-335. It shall presume conformity with these requirements in respect of quality systems that implement the relevant harmonized standard and comply with 333 above.

342 The auditing team shall have at least one member with experience of evaluation in the product technology concerned. The evaluation procedure shall include an inspection visit to the manufacturer's premises.

343 The decision shall be notified to the manufacturer. The notification shall contain the conclusions of the examination and the reasoned assessment decision.

350 Modifications

351 The manufacturer shall undertake to fulfil the obligations arising out of the quality system as approved and to uphold it so that it remains adequate and efficient.

352 The manufacturer or his authorized representative shall keep the Society informed of any intended updating of the quality system.

353 The Society shall evaluate the modifications proposed and decide whether the amended quality system will still satisfy the requirements referred to in paragraph 333-335 or whether a re-assessment is required. It shall notify its decisions to the manufacturer. The notification shall contain the conclusions of the examination and the reasoned assessment decision.
360 Periodical Audit

361 The purpose of the Periodical Audit is to make sure that the manufacturer duly fulfils the obligations arising out of the approved quality system.

362 The manufacturer shall allow the Society entrance for inspection purposes to the locations of manufacture, inspection and testing, and storage and shall provide it with all necessary information in particular:

- the quality system documentation

- the quality records, such as inspection reports and test data, calibration data, qualification reports of the personnel concerned, etc.

363 The Society shall periodically carry out audits to make sure that the manufacturer maintains and applies the quality system and shall provide an audit report to the manufacturer.

364 Additionally the Society may pay unexpected visits to the manufacturer. During such visits the Society may carry out, or cause to be carried out, tests to verify that the quality system is functioning correctly, if necessary. The Society shall provide the manufacturer with a visit report and, if a test has taken place, with a test report.

370 Requirements for CE marking

371 The manufacturer shall, for a period ending at least ten years after the last product has been manufactured, keep at the disposal of the national authorities:

- the documentation referred to in point 332

- the updating referred to in point 352

- the decision and reports from the Society which are referred to in point 333, point 363 and point 364.

372 The manufacturer shall keep a record of all complaints and remedial actions relative to the products.

373 The Society shall give the other notified bodies the relevant information concerning the quality system approvals listed and withdrawn.

380 Production Certificate

381 A Production Certificate is issued on basis of the Type Approval or Type Examination certificate and completed audits under 340 and 350.

400 Product Certification

410 General

411 The content of this text corresponds with the Module F, Product Verification. It is a condition that the product is Type Approved or Type Examined in accordance with 200 to obtain a Product Certification.

412 To correspond with the terminology of the classification system the wording of the text is in some places modified without changing the content of the certification module.

413 The Society is the certification body.

420 Scope

421 This module describes the procedure whereby a manufacturer or his authorized representative checks and attests that the products subject to the provisions of point 423 are in conformity with the type as described in the Type Approval or Type Examination certificate and satisfy the requirements of the Rules that apply to them.

422 The manufacturer shall take all measures necessary in order that the manufacturing process ensures conformity of the products with the type as described in the Type Approval or Type Examination certificate and with the requirements of the Rules that apply to them. He shall affix the certification signboard to each product and shall draw up a declaration of conformity.

423 The Society shall carry out the appropriate examinations and tests in order to check the conformity of the product with the requirements of the Rules either by examination and testing of every product as specified in point 430 or by examination and testing of products on a statistical basis, as specified in point 440, at the choice of the manufacturer.

430 Survey

431 All products shall be individually examined and appropriate tests as set out in the relevant Rules or equivalent tests shall be carried out in order to verify their conformity with the type as described in the Type Approval or Type Examination certificate and the requirements of the Rules that apply to them.

432 The manufacturer or his authorized representative shall ensure that he is able to supply the Society's certificates of conformity on request.

440 Statistical verification

441 The manufacturer shall present his products in the form of homogeneous lots and shall take all measures necessary in order that the manufacturing process ensures the homogeneity of each lot produced.

442 All products shall be available for verification in the form of homogeneous lots. A random sample shall be drawn from each lot. Products in a sample shall be individually examined and appropriate tests as set out in the relevant Rules, or equivalent tests, shall be carried out to ensure their conformity with the requirements of the Rules which apply to them and to determine whether the lot is accepted or rejected.

443 The statistical procedure shall use the following elements:

- the statistical method to be applied,

- the sampling plan with its operational characteristics.
In the case of accepted lots, the Society shall affix, or cause to be affixed, its distinguishing number to each product and shall draw up a written certificate of conformity relating to the tests carried out. All products in the lot may be put on the market except those products from the sample which were found not to be in conformity.

If a lot is rejected, the Society or the competent authority shall take appropriate measures to prevent the putting on the market of that lot. In the event of frequent rejection of lots the Society may suspend the statistical verification.

The manufacturer or his authorized representative shall ensure that he is able to supply the Society's certificates of conformity on request.

Requirements for CE marking

The manufacturer or his authorized representative shall keep a copy of the declaration of conformity for a period ending at least ten years after the last product has been manufactured.

The Society shall affix or cause to be affixed, its distinguishing number to each approved product and draw up a written certificate of conformity relating to the tests carried out.

The manufacturer may, under the responsibility of the Society, affix the latter's distinguishing number during the manufacturing process in cases where statistical verification is applied.

The manufacturer shall keep a record of all complaints and remedial actions relative to the products.

Product Certificate

A Product Certificate is issued for the vessel on basis of the Type Approval or Type Examination Certificate and the surveys of the product under 430 and/or 440.

Unit Certification

510 General

The content of this text corresponds with the Module G, Unit Verification. Unit Certification does not require compliance with any other certification modules in addition.

To correspond with the terminology of the classification system the wording of the text is in some places modified without changing the content of the Certification Module.

The Society is the certification body.

520 Scope

This module describes the procedure whereby the manufacturer ensures and declares that the product concerned, which has been issued with the certificate referred to in point 522, conforms to the requirements of the Rules that apply to it. The manufacturer shall affix the certification signboard to the product and draw up a declaration of conformity.

The Society shall examine the individual product by survey under construction or/and completion survey and carry out the appropriate tests as set out in the relevant Rules, or equivalent tests, to ensure its conformity with the relevant requirements of the Rules.

Documentation

The aim of the technical documentation is to enable conformity with the requirements of the Rules to be assessed and the design, manufacture and operation of the product to be understood.

Unit Certificate

A Unit Certificate is issued for the vessel on basis of approval of the documentation and survey of the construction in accordance with the Rules.

Requirements for CE marking

The Society shall affix, or cause to be affixed, its distinguishing number on the approved product and shall draw up a certificate of conformity concerning the tests carried out.

The manufacturer shall keep a record of all complaints and remedial actions relative to the product.
PART 1 CHAPTER 3

CLASSIFICATION OF VESSELS IN SERVICE

DECEMBER 1997

CONTENTS

100 General ................................................................. 3
110 Application ............................................................... 3
120 Request for classification ........................................... 3
130 Class notation ............................................................ 3
140 Validity of the Classification Certificate ....................... 3
200 Surveys ................................................................. 3
210 Class entry procedure .................................................. 3
220 Surveys in the class period ........................................... 4
230 Renewal of the Classification Certificate ....................... 4
300 In service requirements ............................................... 4
310 Identification ............................................................. 4
320 Maintenance ............................................................. 4
330 Outfitting ............................................................... 4
FOREWORD

Det Norske Veritas is a free-standing, autonomous and independent Foundation with the object of safeguarding life, property and the environment at sea and ashore.

Det Norske Veritas AS, a fully owned subsidiary Society of the Foundation, undertakes classification and certification and secures the quality of ships, mobile offshore units and fixed offshore installations, facilities and systems, and carries out research in connection with these functions. Moreover, the Society, provided its integrity is not impaired, may perform assignments which utilize its knowledge or which contribute to develop knowledge that will be required for the performance of these assignments.

The Foundation was established in 1978 as a direct continuation of the association The Norske Veritas which was established in 1864.

This new rule booklet was approved by the Board in August 1997.
100 General

110 Application

111 This chapter is voluntary and optional for vessels under these Rules and only valid under the classification period on the certificate for the vessel.

112 This chapter of the Rules is applicable to vessels with length of 12 metres and above and with the class notations assigned on basis of these Rules.

113 This chapter is applicable to vessels where the owner of the vessel has committed himself to operate and maintain the vessel in such a way that the safety standard is not degraded during the class period of the certificate.

114 This chapter is applicable to vessels under a system of periodical surveys.

115 This chapter is applicable to vessels to be assigned a Classification Certificate with the notation DNV.

120 Request for classification

121 Request for classification is to be made on behalf of the owner of the vessel, through the yard, as the commitment for the service period of the vessel is to be made by the owner.

122 The request is to give information about the owner’s name, address and contact person responsible for the vessel in addition to a copy of the Module Certificate for the individual vessel.

130 Class notation

131 Vessels holding a Module Certificate with the notations:

- DNV Recreational Craft or

(<>) DNV Recreational Craft

assigned on basis of Unit Certification or Product Certification respectively will be assigned Classification Certificates:

- DNV Yacht or

(<>) DNV Yacht

respectively.

132 Vessels which are not surveyed under construction by the Society may be assigned the class notation DNVYacht

on basis of a complete survey of the vessel on basis of the requirements in Pt.3 and Pt.4 Ch.1 of the Rules.

140 Validity of the Classification Certificate

141 The Classification Certificate has a validity of 5 years.

142 In the class period any change of ownership, modifications, conversions or damages to the vessel is to be reported to the Society and appropriate consequences to the Classification Certificate will be taken.

143 Vessels with the class notation Yacht

will not be surveyed periodically in the class period due to the limited number of service hours for such vessels in normal use.

144 Vessels with the class notation Yacht

which take part in racing competitions where the vessel is exposed to extreme handling will not have a valid classification certificate and class entry has to be requested after the race.

145 The class notation Racing Yacht

is not available under the present edition of the Rules.

200 Surveys

210 Class entry procedure

211 For any individual vessel holding a Classification Certificate with class notation DNV for a service period, sufficient documentation on the vessel is to be filed by the Society to enable an assessment of the safety standard of the vessel in case of any reported damages or modifications.

212 Documentation is to be established at the class entry survey of the vessel, either as classification drawing, specification with photo illustrations or by the surveyor’s report on the condition of the vessel at the survey.

213 For any yacht to enter into class a photo of the craft shall be enclosed the survey report for documentation purpose.

214 Compliance with the requirements of the Rules shall be established either by copy of an individual Module Certificate for the vessel or a detailed survey report of the vessel.

215 The Classification Certificate is issued on basis of an examination of the survey report.
220 Surveys in the class period

221 Any periodical survey or survey of modifications or damages shall be reported and the consequence for the Classification Certificate shall be decided on basis of an examination of the survey report.

230 Renewal of the Classification Certificate

231 Renewal of the Classification Certificate is to follow the same procedure as for the class entry in 210 and has to be requested by the owner.

232 All documentation including the photo has to be updated and submitted as for the first class entry.

300 In service requirements

310 Identification

311 Any vessel to be assigned a Classification Certificate is to be clearly identified to be the vessel for which the classification certificate is issued, either by the name of the vessel or a register number.

312 The identification shall be on both sides of the vessel and be readable at a distance in case of rescue assistance.

320 Maintenance

321 During the class period the vessel is to be continuously maintained to keep the initial safety standard of the vessel.

322 All systems and installations shall work as intended and service parts shall be renewed as required by service instructions for the various installations.

323 Any modifications or repair shall be at least to the initial standard of the vessel.

330 Outfitting

331 Any vessel with the class notation Yacht shall have anchor equipment onboard and in place and order for immediate use.

332 All portable fire extinguishers shall be onboard and in order.

333 A sufficient number of life vests or similar personal buoyant aid is to be onboard.

334 At least one inflatable liferaft is to be onboard and in good order.

335 Emergency equipment is to be onboard as follows as a minimum:
   - one smoke signal
   - three lights
   - one whistle.
PART 3 CHAPTER 1

DESIGN LOADS

DECEMBER 1997

CONTENTS

100 General.................................................................3
110 Application..........................................................3
120 Hull girder strength................................................3
130 Local vibrations.....................................................3
200 Design loads for vessels with length \( L_b \leq 24 \, \text{m} \) ....3
210 General.................................................................3
220 Sea pressure on hull bottom........................................3
230 Sea pressure on hull side...........................................5
240 Design loads on decks and super-structures...............5
250 Design loads for bulkheads and tanks.......................5
FOREWORD

Det Norske Veritas is a free-standing, autonomous and independent Foundation with the object of safeguarding life, property and the environment at sea and ashore.

Det Norske Veritas AS, a fully owned subsidiary Society of the Foundation, undertakes classification and certification and secures the quality of ships, mobile offshore units and fixed offshore installations, facilities and systems, and carries out research in connection with these functions. Moreover, the Society, provided its integrity is not impaired, may perform assignments which utilize its knowledge or which contribute to develop knowledge that will be required for the performance of these assignments.

The Foundation was established in 1978 as a direct continuation of the association The Norske Veritas which was established in 1864.

This new rule booklet was approved by the Board in August 1997.
100 General

110 Application

111 The design loads given in this chapter are applicable to the following categories of vessels:

- All vessels with length \( L_h \leq 24 \) m

112 The design loads specified for vessels with length \( L_h \leq 24 \) m are considered to satisfy the design load levels implied by the various design categories defined in the EU Directive for Recreational Craft.

113 Based on evaluation of local weather/wave statistics reduced design loads may be applied. In such cases geographical service restrictions will be added to the class notation.

114 The design loads in this chapter should only be applied in association with the strength formulae given in Pt.3.

115 Definitions of main particulars are given in Pt.4 Ch. I.

120 Hull girder strength

121 For vessels with length \( L_h \leq 24 \) m the minimum strength standard is normally satisfied for scantlings obtained from local strength requirements.

130 Local vibrations

131 The evaluation of structural response to vibrations caused by impulses from engine and propeller blades is not covered by the classification.

200 Design loads for vessels with length \( L_h \leq 24 \) m

210 General

211 The design loads given in this section are derived from the Nordic Boat Standard for vessels less than 15 m which are accepted by the Maritime Authorities of the Nordic countries.

220 Sea pressure on hull bottom

221 The design sea pressure acting on the hull bottom is not to be taken less than:

\[ P_b = \text{PF}_b \cdot k_{1b} \cdot k_5 \cdot k_a \text{ (kN/m}^2\text{)} \]

\( \text{PF}_b \) = pressure factor taken from Figure 1

\( v \) = maximum speed at light displacement

\( k_{1b} \) = correction for deadrise angle applicable to vessels with speed \( v > 3 \sqrt{L_h} \) and length \( L_h \leq 9 \) m, taken from Figure 3. The deadrise angle is not to be taken greater than 22 degrees.

\( k_a \) = area reduction factor considering the size of the design area, \( A_d \), relative to the reference area \( A_0 \) to be taken from Figure 4.

\( A_d = s^2 \text{ (m}^2\text{)} \) for plates and panels

\( A_d = s \cdot l \text{ (m}^2\text{)} \) for frames/stiffeners

\( s \) = shortest panel edge or load breadth for stiffening members in metres.

\( l \) = span length of stiffening members in metres.

\[ k_{1b} = \text{correction for deadrise angle applicable to vessels with speed } v > 3 \sqrt{L_h} \text{ and length } L_h \leq 9 \text{ m, taken from Figure 3. The deadrise angle is not to be taken greater than 22 degrees.} \]

\[ k_a = \text{area reduction factor considering the size of the design area, } A_d, \text{ relative to the reference area } A_0, \text{ to be taken from Figure 4.} \]

\[ A_d = s^2 \text{ (m}^2\text{)} \text{ for plates and panels} \]

\[ A_d = s \cdot l \text{ (m}^2\text{)} \text{ for frames/stiffeners} \]

\[ s = \text{shortest panel edge or load breadth for stiffening members in metres.} \]

\[ l = \text{span length of stiffening members in metres.} \]
222. The vertical extension of the design sea pressure, $P_1$, shall be as follows (see Figure 5):

- up to the deepest w.l. for vessels with $V < 3 \sqrt{L_h}$
- up to the chine for vessels with $V > 3 \sqrt{L_h}$.

Figure 2 Longitudinal distribution factor $k_{1b}$

Figure 3 Deadrise angle

Figure 4 Area reduction factor

Figure 5 Extension of design sea pressure
230 Sea pressure on hull side

231 The design sea pressure acting on the hull side is not to be taken less than:

$$P_s = P_{F_1} \cdot k_h \cdot k_a \cdot k_v \quad (\text{kN/m}^2)$$

$P_{F_1}$ - pressure factor taken from Figure 6

$V$ - maximum speed at light displacement.

$k_h$ = longitudinal distribution factor to be taken from Figure 7

$k_v$ = vertical distribution factor

$=$ minimum 0.5 for design category A and B,

$=$ minimum 0.3 for design category C and D

$$F_v = \frac{4.5}{1000 \cdot L_h \cdot B_s}$$

$h$ = distance from side/bottom transition to the load point considered in meters.

Figure 6 Pressure factor $P_{F_1}$

Figure 7 Longitudinal distribution factor $k_h$

$F_v$, $h$, and $k_v$ are shown on Figure 8.

The design categories are defined in Pt.4 Ch.1.

240 Design loads on decks and super-structures

241 The design sea pressure acting on decks is not to be taken less than:

$$p_u = k_d \cdot L_h + 4.5 \quad (\text{kN/m}^2)$$

$k_d$ = 0.2; exposed main weather deck and superstructure deck forward of 0.25Lh from FP

$=$ 0.1; exposed superstructure decks elsewhere.

The design pressure for boats in categories C and D may be reduced with 25 %.

242 The design load for accommodation decks and decks intended for cargo is to be taken as:

$$p_{uc} = 10 \cdot H \left(1 + 0.2 \sqrt[3]{L_h} \right) \quad (\text{kN/m}^2)$$

$H$ = deck cargo in t/m$^2$

$=$ 0.35 t/m$^2$ for accommodation decks.

243 The design sea pressure on super-structures and deck houses is not to be taken less than given in the table below:

<table>
<thead>
<tr>
<th>Position</th>
<th>$p$ (kN/m$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front bulkhead</td>
<td>0.3 L_h + 6</td>
</tr>
<tr>
<td>Sides and aft bulkhead</td>
<td>0.15 L_h + 3</td>
</tr>
<tr>
<td>Deck house roof, 1st tier</td>
<td>0.1 L_h + 3</td>
</tr>
<tr>
<td>&quot;</td>
<td>0.1 L_h + 1.5</td>
</tr>
</tbody>
</table>

The design pressure for boats in categories C and D may be reduced with 25 %.

250 Design loads for bulkheads and tanks

251 The design load for watertight bulkheads is not to be taken less than:

$$p_{bh} = 10 \cdot h_b \quad (\text{kN/m}^2)$$

$h_b$ = distance from load point to top of bulkhead.
The design load for tanks for oil, freshwater, water ballast, etc. is not to be taken less than:

\[ p_t = 7 \cdot h_t \quad (\text{kN/m}^2) \]

\[ = \text{minimum } 15 \quad (\text{kN/m}^2) \]

\( h_t \) = distance from load point to top of air pipe or filling pipe whichever is the greater.
PART 3 CHAPTER 2

STEEL AND ALUMINIUM CONSTRUCTIONS

DECEMBER 1997

CONTENTS

100 General ................................................................. 3
110 Application ............................................................ 3
120 Definitions ............................................................... 3
130 Structural steel materials .......................................... 3
140 Structural aluminium materials ................................. 3
150 Structural design in general ........................................ 3
160 Global strength ......................................................... 4
200 Structural arrangement .............................................. 4
210 Bottom structures .................................................... 4
220 Side structure .......................................................... 5
230 Deck structure ......................................................... 5
240 Bulkhead structures .................................................. 5
250 Superstructures and deckhouses ................................. 6
300 Steel and aluminium plating .................................... 6
310 General ................................................................. 6
320 Plate thickness ........................................................ 6
400 Frames, beams and other stiffeners ......................... 7
410 General ................................................................. 7
420 Section modulus ....................................................... 7
500 Pillars ................................................................. 9
510 General ................................................................. 9
520 Scantlings ............................................................... 9
FOREWORD

Det Norske Veritas is a free-standing, autonomous and independent Foundation with the object of safeguarding life, property and the environment at sea and ashore.

Det Norske Veritas AS, a fully owned subsidiary Society of the Foundation, undertakes classification and certification and secures the quality of ships, mobile offshore units and fixed offshore installations, facilities and systems, and carries out research in connection with these functions. Moreover, the Society, provided its integrity is not impaired, may perform assignments which utilize its knowledge or which contribute to develop knowledge that will be required for the performance of these assignments.

The Foundation was established in 1978 as a direct continuation of the association The Norske Veritas which was established in 1864.

This new rule booklet was approved by the Board in August 1997.
100 General

110 Application

111 The rules in this chapter apply to steel and aluminium structures for the assignment of the main class notation DNV.

112 Additional or modified requirements may be given in association with the various type and service notations.

120 Definitions

130 Structural steel materials

131 Structural materials shall comply with the requirements of Pt. 7 Ch. I.

132 The scantling requirements in this chapter are based on the use of normal strength structural steel with yield point not less than 235 N/mm².

133 In the case steel materials with a higher yield strength are used, the scantling requirements, as given in the various formulae, shall be adjusted with the factor \( f_i \) taken from the table below:

<table>
<thead>
<tr>
<th>Minimum yield strength (N/mm²)</th>
<th>( f_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td>265</td>
<td>0.93</td>
</tr>
<tr>
<td>315</td>
<td>0.78</td>
</tr>
<tr>
<td>355</td>
<td>0.72</td>
</tr>
<tr>
<td>390</td>
<td>0.70</td>
</tr>
</tbody>
</table>

140 Structural aluminium materials

141 Structural aluminium materials shall comply with requirements of Pt. 7 Ch. I.

142 Compliance with the requirements shall be documented in accordance with Pt. 1 Ch. 2 300.

143 The scantling requirements of this chapter are based on the properties of the material as fabricated (no deformation hardening) with minimum properties in accordance with the table below:

<table>
<thead>
<tr>
<th>Material</th>
<th>Tensile strength N/mm²</th>
<th>Yield strength * N/mm²</th>
<th>( f_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td>AlMg3Mn</td>
<td>240</td>
<td>110</td>
<td>1.32</td>
</tr>
<tr>
<td>AlMg4</td>
<td>250</td>
<td>110</td>
<td>1.32</td>
</tr>
<tr>
<td>AlMg4,5Mn</td>
<td>270</td>
<td>145</td>
<td>1.00</td>
</tr>
<tr>
<td>AlMgSi</td>
<td>170</td>
<td>115</td>
<td>1.26</td>
</tr>
</tbody>
</table>

\* Applies to welded condition.

144 If deformation hardened aluminium qualities are used for glued or riveted constructions the correction factor \( f_i \) is to be taken as \( \frac{\sigma_y}{\sigma_u} \) where \( \sigma_y \) is the yield strength of the material in the actual hardened condition, not to be taken above 70% of the ultimate tensile strength.

150 Structural design in general

151 Attention is drawn to the importance of structural continuity in general.

152 The ship arrangement is to take into account:

- Continuity of longitudinal strength, including horizontal shear area to carry a strength deck along.
- Transverse bulkheads or strongwebs.
- Web/pillar rings in engine room.
- Superstructures and deckhouses:
  - direct support
  - transitions
- Deck equipment support
- Multi-deck pillars in line, as practicable
- External attachments, inboard connections.

153 Gradual taper and/or soft transition of structural members should be aimed at.

154 End brackets, tripping brackets etc. are not to terminate on unsupported plating.

Brackets are to extend to the nearest stiffener, or local plating reinforcement is to be provided at the toe of the bracket.

155 Doubles should be avoided normal to a tensile force.

156 Generally, connections of out-fitting details to the hull are to be such that stress-concentrations are minimised and welding to high stressed parts are avoided as far as possible.

Connections are to be designed with smooth transitions and proper alignment with the hull structure elements. Terminations are to be supported.

157 Connections to top flange of girders and stiffeners are to be avoided if not well smoothened. Preferably, supporting of out-fittings are to be welded to the stiffener web.

158 The effective span of a stiffener (I) or girder (S) depends on the design of the end connections in relation to adjacent structures. Unless otherwise stated the span points at each end of the member, between which the span is measured, is to be determined as shown in Figure 1. It is assumed that brackets are effectively supported by the adjacent structure.
160 Global strength

161 The local strength requirements normally provide scantlings which satisfy the minimum global strength standard.

162 For vessels with large deck openings, a low depth to length ratio or large concentrated loads it may be necessary to check the midship section modulus.

163 The midship section modulus should not be less than:

\[ Z = 7.3 \cdot \frac{L^2}{f_t} \cdot B \cdot (C_n + 0.7) \] \( \text{(cm}^3) \)

\( C_n \) is not to be taken less than 0.5.

164 When calculating the moment of inertia and section modulus of the midship section, the effective sectional area of continuous longitudinal strength members is in general the net area after deduction of openings.

Superstructures which do not form a strength deck are not to be included in the net section. This applies also to deckhouses and bulwarks.

The effect of openings are assumed to have longitudinal extensions as shown by the shaded areas in Figure 2 i.e. inside tangents at an angle of 30° to each other. Example for transverse section III:

\[ B_{\text{III}} = b' + b'' + b''' \]

For twin hull vessels the effective breadth of wide decks without longitudinal bulkhead support will be considered.

200 Structural arrangement

210 Bottom structures

211 The bottom structure shall comply with the requirements given in 300 and 400. The local strength of the keel shall be sufficient to withstand loads in connection with docking attachment of external ballast keel, etc.

212 Bottom structures may be longitudinally or transversely stiffened.

213 In planning craft single bottom as well as double bottoms are normally to be longitudinally stiffened.

214 The longitudinals should preferably be continuous through transverse members. If they are to be cut at transverse members, i.e. watertight bulkheads, continuous brackets connecting the ends of the longitudinals are to be fitted or welds are to be dimensioned accordingly.

Longitudinal stiffeners are to be supported by bulkheads and web frames.

215 Displacement vessels with single bottom and transverse frames are to have floors at each frame. The floors are to be continuous from side to side.

216 Web frames are to be continuous around the cross section i.e. floors side webs and deck beams are to be connected. Intermediate floors may be used.

In the engine room plate floors are to be fitted at every frame. In way of thrust bearings additional strengthening is to be provided.
217 Longitudinal girders are to be carried continuously through bulkheads. In craft built in sandwich construction longitudinal girders may be fitted to support the bottom panels.

A centre girder is to be fitted for docking purpose if the external keel or bottom shape does not give sufficient strength and stiffness.

Openings should not be located at ends of girders without due consideration being taken to shear loadings.

218 Under the main engine, girders extending from the bottom to the top plate of the engine seating are to be fitted.

Engine holding down bolts are to be arranged as near as practicable to floors and longitudinal girders.

In way of thrust bearing and below pillars additional strengthening is to be provided.

219 Manholes are to be cut in the inner bottom, floors and longitudinals girders to provide access to all parts of the double bottom. The vertical extension of lightening holes is not to exceed one half of the girder height. The edges of the manholes are to be smooth. Manholes in the inner bottom plating are to have reinforcement rings. Manholes are not to be cut in the floors or girders in way of pillars.

In double bottoms with longitudinal stiffening, the floors are to be stiffened at every bottom longitudinal.

In double bottoms with transverse stiffening, longitudinal girders are to be stiffened at every transverse frame.

The longitudinal girders are to be satisfactorily stiffened against buckling.

220 Side structure

221 The scantlings of side structures shall comply with the requirements given in 300 and 400.

222 The craft’s sides may be longitudinally or vertically stiffened.

223 The continuity of longitudinals is to be as required for bottom and deck longitudinals respectively.

224 Vertical side frames shall normally be connected to floors and deck beams with well rounded transitions and a continuous flange laminate.

230 Deck structure

231 The scantlings of deck structures shall comply with the requirements given in 300 and 400.

232 Decks may be longitudinally or transversely stiffened.

233 Longitudinals should preferably be continuous through transverse members. If they are to be cut at transverse members, i.e. watertight bulkheads, continuous brackets connecting the ends of the longitudinals are to be fitted.

234 The plate thickness is to be such that the necessary transverse buckling strength is achieved, or transverse buckling stiffeners may have to be fitted intercostally.

235 The thickness of bulwark plates is not to be less than required for side plating in a superstructure in the same position.

A strong bulb section or similar is to be continuously welded to the upper edge of the bulwark. Bulwark stays are to be in line with transverse beams or local transverse stiffening. The stays are to have sufficient width at deck level. The deck beam is to be continuously welded to the deck in way of the stay. Bulwarks on forecastle decks are to have stays fitted at every frame.

Stays of increased strength are to be fitted at ends of bulwark openings. Openings in bulwarks should not be situated near the ends of superstructures.

236 Where bulwarks on exposed decks form wells, ample provision is to be made to freeing the decks for water.

240 Bulkhead structures

241 The scantlings of bulkhead structures shall comply with the requirements given in 300 and 400.

242 Number and location of transverse watertight bulkheads are to be in accordance with the requirements given for the various vessel types specified in Pt.4.

243 The stiffening of the upper part of a plane transverse bulkhead is to be such that the necessary transverse buckling strength is achieved.

244 Longitudinal and transverse bulkheads may be corrugated.

For corrugated bulkheads the following definition of spacing applies (see Figure 3):

\[ s = \frac{s_1}{1.05} \text{ for section modulus calculations} \]

\[ -1.05 s_2 \text{ or } 1.05 s_3 \text{ for plate thickness calculations.} \]

**Figure 3** Corrugated bulkhead
245 Bulkheads supporting decks are to be regarded as pillars. The compressive loads and buckling strength are to be calculated as indicated in 500 assuming:

\[ i = \text{radius of gyration in cm of stiffener with adjoining plate.} \]

Width of adjoining plate is to be taken as \(40 t\), where \(t\) = plate thickness.

Local buckling strength of adjoining plate and torsional buckling strength of stiffeners are to be checked in accordance with 500.

250 Superstructures and deckhouses

251 The scantlings of superstructures and deckhouses shall comply with the requirements of 300 and 400.

252 Superstructure is defined as a decked structure on the freeboard deck, extending from side to side of the ship or with the side plating not inboard of the shell plating more than 4 % of the breadth (B).

Deckhouse is defined as a decked structure above the strength deck with the side plating being inboard of the shell plating more than 4 % of the breadth (B).

Long deckhouse is deckhouse having more than 0.2 L of its length within 0.4 L amidships.

Short deckhouse is deckhouse not defined as a long deckhouse.

253 In superstructures and deckhouses, the front bulkhead is to be in line with a transverse bulkhead in the hull below or be supported by a combination of girders and pillars. The after end bulkhead is also to be effectively supported. As far as practicable, exposed sides and internal longitudinal and transverse bulkheads are to be located above girders and frames in the hull structure and are to be in line in the various tiers of accommodation. Where such structural arrangement in line is not possible, there is to be other effective support.

254 Sufficient transverse strength is to be provided by means of transverse bulkheads or girder structures.

255 At the break of superstructures, which have no set-in from the ship's side, the side plating is to extend beyond the ends of the superstructure, and is to be gradually reduced in height down to the deck or bulwark. The transition is to be smooth and without local discontinuities. A substantial stiffener is to be fitted at the upper edge of plating. The plating is also to be additionally stiffened.

256 In long deckhouses, openings in the sides are to have well-rounded corners. Horizontal stiffeners are to be fitted at the upper and lower edge of large openings for windows. Openings for doors in the sides are to be substantially stiffened along the edges. The connection area between deckhouse corners and deck plating is to be increased locally.

Deck girders are to be fitted below long deckhouses in line with deckhouse sides.

257 Deck beams under front and aft ends of deckhouses are not to be scalloped for a distance of 0.5 m from each side of the deckhouse corners.

258 For deckhouse side stiffeners the scantlings need not be greater than required for tween deck frames with equivalent end connections.

259 Casings supporting one or more decks above are to be adequately strengthened.

300 Steel and aluminium plating

310 General

311 In this section the general requirements for the local strength of laterally loaded plates are given.

320 Plate thickness

321 Plate thicknesses shall be not less than the largest value found from the following formulae:

\[ t_{\text{min}} = t_0 + k \cdot \sqrt{f_p} + t_c \] (mm)

\[ t_p = K_p \cdot f_p \cdot \sqrt{B} + t_c \] (mm).

The material factor, \(K_p\), is to be taken as:

\[ K_p = 1,03 \] for steel

\[ K_p = 1,86 \] for aluminium.

\(t_0\) and \(k\) are given in the tables in 322.

\(f_p\) is given in 323.

\(t_c\) = corrosion allowance for steel constructions as given for the respective type and service notations. To be taken as zero for aluminium constructions.

322 \(t_0\) and \(k\) are to be taken from the tables below:

<table>
<thead>
<tr>
<th>STEEL</th>
<th>(L \leq 15 \text{ m})</th>
<th>(L &gt; 15 \text{ m})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(t_0)</td>
<td>(k)</td>
</tr>
<tr>
<td>Hull bottom</td>
<td>1,0</td>
<td>0,23 (k_e k_d)</td>
</tr>
<tr>
<td>Hull side</td>
<td>0,5</td>
<td>0,2 (k_d)</td>
</tr>
<tr>
<td>Transom, not supporting engine</td>
<td>0,5</td>
<td>0,23</td>
</tr>
<tr>
<td>Exposed/ cargo deck</td>
<td>0,3</td>
<td>0,21+0,1H</td>
</tr>
<tr>
<td>Accommodation deck</td>
<td>0,3</td>
<td>0,21</td>
</tr>
<tr>
<td>Superstr. and deckhouses</td>
<td>0</td>
<td>0,21</td>
</tr>
<tr>
<td>Structural/ watertight bulkheads</td>
<td>0</td>
<td>0,21</td>
</tr>
</tbody>
</table>
\[ k_d = \sqrt{\frac{\Delta}{\Delta_{\text{max}}}} \]

applies only to recreational craft according to Pt.4 Ch.1

\[ k_w = 0.86 + 0.014V \]

\[ H = \text{deck cargo in t/m}^2 \]

<table>
<thead>
<tr>
<th>ALUMINIUM</th>
<th>( L \leq 15 \text{ m} )</th>
<th>( L &gt; 15 \text{ m} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hull bottom</td>
<td>1.5 0.23 ( k_d )</td>
<td>4.3 0.04</td>
</tr>
<tr>
<td>Hull side</td>
<td>1.0 0.23</td>
<td>3.8 0.04</td>
</tr>
<tr>
<td>Transom, not</td>
<td>1.0 0.23</td>
<td>3.8 0.04</td>
</tr>
<tr>
<td>supporting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>engine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed/ cargo</td>
<td>0.8 0.21+0.21H</td>
<td>3.7 0.03</td>
</tr>
<tr>
<td>deck</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accommodation</td>
<td>0.8 0.21</td>
<td>3.5 0.03</td>
</tr>
<tr>
<td>deck</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superstr. and</td>
<td>0.4 0.21</td>
<td>3.1 0.03</td>
</tr>
<tr>
<td>deckhouses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural/ watertight</td>
<td>0.4 0.21</td>
<td>3.1 0.03</td>
</tr>
<tr>
<td>bulkheads</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

323 The combined correction factor \( f_p \) is given by:

\[ f_p = \sqrt{f_1 \cdot f_2 \cdot f_3} \]

The aspect ratio correction factor, \( f_2 \), is to be taken as:

\[ f_2 = (1,1 - 0.25 s/l)^3 \]

= maximum 1.0

= minimum 0.72.

The correction factor, \( f_3 \), for plate curvature is to be taken as:

\[ f_3 = 1 - \frac{h}{s} \]

= minimum 0.8.

\( h \) and \( s \) are defined in Figure 4.

Figure 4 Definition of \( h \) and \( s \)

400 Frames, beams and other stiffeners

410 General

In this section the general requirements for the strength of laterally loaded frames, beams and other stiffeners in steel and aluminium constructions are given.

420 Section modulus

\[ W = 10^{-3} \cdot K_s \cdot m \cdot f_1 \cdot p \cdot b \cdot l^2 \]

\[ K_s \geq 6.25 \text{ for steel} \]

\[ - 10.4 \text{ for aluminium.} \]

\( m \)-values for the most common structural members are found in the table in 423.

\( l \)-value for load breadth in metres

\( l \)-value for stiffener span in metres

\( l_0 \)-value for the straight part of the frame in bottom. When the bilge radius is constant, \( l_0 \) is measured as shown in Figure 5. When the radius varies, \( l_0 \) is measured as shown in Figure 6.

\( R \)-value for bilge radius in metres.

Figure 5 Definition of \( l_0 \) for constant bilge radius
423. The m-values are normally to be taken as follows for the various structural members:

<table>
<thead>
<tr>
<th>Item</th>
<th>m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous longitudinals</td>
<td>85</td>
</tr>
<tr>
<td>Non-continuous longitudinals</td>
<td>100</td>
</tr>
<tr>
<td>Transverse</td>
<td>100</td>
</tr>
<tr>
<td>Vertical members, ends fixed</td>
<td>100</td>
</tr>
<tr>
<td>Vertical members, simply supported</td>
<td>135</td>
</tr>
<tr>
<td>Bottom longitudinal</td>
<td>85</td>
</tr>
<tr>
<td>Bottom transverse</td>
<td>100</td>
</tr>
<tr>
<td>Side longitudinal</td>
<td>85</td>
</tr>
<tr>
<td>Side vertical</td>
<td>100</td>
</tr>
<tr>
<td>Deck longitudinal</td>
<td>85</td>
</tr>
<tr>
<td>Deck transverse</td>
<td>100</td>
</tr>
<tr>
<td>W.T. bulkhead, fixed ends</td>
<td>65</td>
</tr>
<tr>
<td>W.T. bulkhead, fixed one end</td>
<td>85</td>
</tr>
<tr>
<td>W.T. bulkhead, simply supported ends</td>
<td>125</td>
</tr>
<tr>
<td>Tank and cargo bulkheads, fixed ends</td>
<td>100</td>
</tr>
<tr>
<td>Tanks and cargo bulkheads, simply supported</td>
<td>135</td>
</tr>
<tr>
<td>Deckhouse stiffener</td>
<td>100</td>
</tr>
<tr>
<td>Casing</td>
<td>100</td>
</tr>
</tbody>
</table>

424. The formula given in 421 is to be regarded as the requirement about an axis parallel to the plating. As an approximation the requirement to standard section moduli for stiffeners at an oblique angle with the plating may be obtained if the formula in 421 is multiplied by the factor:

\[ \frac{1}{\cos \alpha} \]

\( \alpha = \) angle between the stiffener web plane and plane perpendicular to the plating.

For \( \alpha \)-values less than 15° corrections are normally not necessary.

425. When several members are equal, the section modulus requirement may be taken as the average requirement for each individual member in the group. However, the requirement for the group is not to be taken less than 90% of the largest individual requirement.

**Effective plate flange**

may normally be taken equal to the stiffener spacing.

426. The thickness of web and flange is not to be less than:

\[ t_{\text{web}} \text{ for flats} = \frac{1}{15} \times \text{flat depth} \]

\[ t_{\text{web}} \text{ for other sections} = \frac{1}{50} \times \text{web depth}, \text{provided net shear area} \geq 0.075 \text{kip} \]

\[ t_{\text{flange}} = \frac{1}{15} \times \text{flange width from web} \]
500 Pillars

510 General

511 In this section the general requirements to steel pillars supporting structure or equipment are given.

512 Where practicable, deck pillars are to be located in line with pillars above or below. Otherwise beams or girders in deck in way will have to be reinforced.

520 Scantlings

521 Solid steel pillars shall have dimensions according to the table below:

<table>
<thead>
<tr>
<th>$l \cdot b \cdot p$</th>
<th>Pillar length in metres</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter in mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>50</td>
<td>53</td>
<td>56</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>53</td>
<td>56</td>
<td>60</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>56</td>
<td>60</td>
<td>65</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>59</td>
<td>64</td>
<td>69</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>62</td>
<td>68</td>
<td>73</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>130</td>
<td>65</td>
<td>71</td>
<td>77</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td>68</td>
<td>75</td>
<td>81</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>71</td>
<td>78</td>
<td>84</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>240</td>
<td>74</td>
<td>81</td>
<td>88</td>
<td>94</td>
<td></td>
</tr>
<tr>
<td>290</td>
<td>77</td>
<td>84</td>
<td>91</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td>340</td>
<td>80</td>
<td>88</td>
<td>95</td>
<td>102</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>83</td>
<td>91</td>
<td>99</td>
<td>106</td>
<td></td>
</tr>
</tbody>
</table>

$l$ and $b$ are length and breadth in metres of deck area supported by the pillar. In most cases the area extends halfway to nearest pillar, bulkhead or vessel’s side.

522 Tubular pillars shall have dimensions according to the table below, based on the scantlings of solid pillars:

<table>
<thead>
<tr>
<th>Diameter of solid pillars (mm)</th>
<th>Pillar length in metres</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>50</td>
<td>70x6,0</td>
<td>70x6,0</td>
<td>70x6,0</td>
<td>70x6,0</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>70x6,0</td>
<td>70x6,0</td>
<td>70x6,0</td>
<td>70x6,0</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>80x6,5</td>
<td>75x6,0</td>
<td>75x6,0</td>
<td>75x6,0</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>90x6,5</td>
<td>80x6,5</td>
<td>80x6,5</td>
<td>80x6,0</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>100x7,0</td>
<td>90x6,5</td>
<td>90x6,5</td>
<td>90x6,0</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>115x7,0</td>
<td>110x6,5</td>
<td>110x6,5</td>
<td>110x6,5</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>130x7,5</td>
<td>120x7,0</td>
<td>115x7,0</td>
<td>105x6,5</td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>145x8,0</td>
<td>130x7,5</td>
<td>125x7,0</td>
<td>115x7,0</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>160x8,5</td>
<td>145x8,0</td>
<td>135x7,5</td>
<td>125x7,0</td>
<td></td>
</tr>
</tbody>
</table>
PART 3 CHAPTER 3

COMPOSITE CONSTRUCTIONS

DECEMBER 1997

CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>General</td>
<td>3</td>
</tr>
<tr>
<td>110</td>
<td>Application</td>
<td>3</td>
</tr>
<tr>
<td>120</td>
<td>Assumptions</td>
<td>3</td>
</tr>
<tr>
<td>130</td>
<td>Definitions</td>
<td>3</td>
</tr>
<tr>
<td>140</td>
<td>Calculation methods</td>
<td>3</td>
</tr>
<tr>
<td>150</td>
<td>Structural design in general</td>
<td>3</td>
</tr>
<tr>
<td>160</td>
<td>Materials</td>
<td>4</td>
</tr>
<tr>
<td>170</td>
<td>Mechanical properties of laminate</td>
<td>4</td>
</tr>
<tr>
<td>180</td>
<td>Mechanical properties of sandwich core materials</td>
<td>4</td>
</tr>
<tr>
<td>190</td>
<td>Global strength</td>
<td>4</td>
</tr>
<tr>
<td>200</td>
<td>Structural arrangement</td>
<td>5</td>
</tr>
<tr>
<td>210</td>
<td>Bottom structures</td>
<td>5</td>
</tr>
<tr>
<td>220</td>
<td>Side structures</td>
<td>5</td>
</tr>
<tr>
<td>230</td>
<td>Transom structure</td>
<td>5</td>
</tr>
<tr>
<td>240</td>
<td>Deck structure</td>
<td>6</td>
</tr>
<tr>
<td>250</td>
<td>Bulkhead structures</td>
<td>6</td>
</tr>
<tr>
<td>260</td>
<td>Superstructures and deckhouses</td>
<td>6</td>
</tr>
<tr>
<td>300</td>
<td>Single skin constructions</td>
<td>7</td>
</tr>
<tr>
<td>310</td>
<td>General</td>
<td>7</td>
</tr>
<tr>
<td>320</td>
<td>Laminate thickness</td>
<td>7</td>
</tr>
<tr>
<td>330</td>
<td>Local laminate reinforcement</td>
<td>8</td>
</tr>
<tr>
<td>400</td>
<td>Sandwich constructions</td>
<td>9</td>
</tr>
<tr>
<td>410</td>
<td>General</td>
<td>9</td>
</tr>
<tr>
<td>420</td>
<td>Panel requirements</td>
<td>9</td>
</tr>
<tr>
<td>430</td>
<td>Local panel reinforcements</td>
<td>11</td>
</tr>
<tr>
<td>500</td>
<td>Frames, beams and other stiffeners</td>
<td>11</td>
</tr>
<tr>
<td>510</td>
<td>General</td>
<td>11</td>
</tr>
<tr>
<td>520</td>
<td>Section modulus</td>
<td>11</td>
</tr>
</tbody>
</table>
FOREWORD

Det Norske Veritas is a free-standing, autonomous and independent Foundation with the object of safeguarding life, property and the environment at sea and ashore.

Det Norske Veritas AS, a fully owned subsidiary Society of the Foundation, undertakes classification and certification and secures the quality of ships, mobile offshore units and fixed offshore installations, facilities and systems, and carries out research in connection with these functions. Moreover, the Society, provided its integrity is not impaired, may perform assignments which utilize its knowledge or which contribute to develop knowledge that will be required for the performance of these assignments.

The Foundation was established in 1978 as a direct continuation of the association The Norske Veritas which was established in 1864.

This new rule booklet was approved by the Board in August 1997.
100 General

110 Application

111 The rules in this chapter apply to glassfibre reinforced unsaturated polyester (GRP) single skin and sandwich constructions for the assignment of the main class notation DNV.

112 Additional or modified requirements may be given in association with the various type and service notations.

113 Alternative scantling determination methods may be accepted upon consideration in each individual case.

120 Assumptions

121 A single skin construction is considered to be a structure consisting of a GRP shell laminate supported and stiffened locally by a system of closely spaced GRP stiffeners.

122 A sandwich construction is considered to be a structural element consisting of three components: A GRP skin laminate on each side of a low-density core. It is assumed that the properties and the proportions of the component materials are such that when a sandwich panel is exposed to a lateral load, the bending moments are carried by the skins and the shear forces by the core. The conditions for compliance with this assumption is given in 140. It is further assumed that an efficient bond between skins and core is obtained.

130 Definitions

131 The following symbols are applied:

- **σₘₐₜ** = breaking strength of GRP laminate in tension or compression in MPa
- **Eₐ** = modulus of elasticity of GRP laminate in tension or compression in MPa
- **σₘₜ** = breaking strength in bending of GRP laminate in MPa
- **Eₙ** = modulus of elasticity in bending of GRP laminate in MPa
- **τₒ** = breaking strength in shear of sandwich core material in MPa
- **fₒ** = \( \frac{80}{σₘₜ} \) correction factors for strength to be \( \leq 1 \)
- **f_c** = \( \frac{130}{σₘₜ} \)
- **t** = laminate thickness in mm, either for a single skin plate or a sandwich skin laminate

s = shortest panel edge for single skin and sandwich panels
b = load breadth for stiffening members in metres
l = span length of stiffening members in metres.

132 Definitions of main particulars are given in Pt.4 Ch.1.

140 Calculation methods

141 To determine stresses and deflections in GRP single skin and sandwich constructions either direct calculations using the full stiffness and strength properties of the laminate in all directions or a simplified method in accordance with Section 5, 6 and 7 in this part will be accepted.

142 The simplified method may be employed on the following conditions:

1) The principal directions of the laminate reinforcement is parallel to the panel edges.
2) The difference in elastic modulus in the two principal directions is not more than 20%.
3) The skin laminates of sandwich panels are thin, i.e. \( d/t > 5.77 \).

143 Direct calculations based on the full strength and stiffness properties in all directions shall be carried out in accordance with the procedures given in the Rules for Classification of High Speed and Light Craft.

150 Structural design in general

151 Attention is drawn to the importance of structural continuity in general.

152 The structural arrangement is to take into account:

- continuity of longitudinal strength, including horizontal shear area to carry a strength deck along
- transverse bulkheads or strongwebs
- web/pillar rings in engine room
- twin hull connections
- superstructures and deckhouses:
  - direct support
  - transitions
- deck equipment support
- multi-deck pillars in line, as practicable
- external attachments, inboard connections.

153 Corners and dimensional transitions shall be well rounded to avoid stress concentrations.

154 Tensile loads perpendicular to the plane of the laminate should be avoided.

155 Thickness differences in laminates should be tapered over a length of at least 20 x thickness difference.
Overlap between layers of reinforcement shall be such that the in-plane shear strength of the joint is at least equal to the axial strength of the reinforcement. For most standard reinforcements this is achieved with an overlap of 40 mm.

In bolt and nail connections the distance from the laminate edge to the centre of the hole shall be 3 x and 2.5 x hole diameter respectively. Distance between nail shall be at least 2.5 x hole diameter and for bolts at least 3.0 x hole diameter. Bolts and nails shall normally be fitted with washers with diameter 2.0 x hole diameter in both ends.

Materials

Structural materials shall be Type Approved.

Mechanical properties of laminate

The rule requirements are based on the following minimum properties of structural laminates:

- Tensile strength, $\sigma_t = 80$ MPa
- Tensile modulus, $E_t = 7000$ MPa
- Bending strength, $\sigma_b = 130$ MPa
- Bending modulus, $E_b = 6000$ MPa

The glass content of the cured laminates is to be at least 27% by weight measured in accordance with ISO/R 1172-1975. All individual test result values are to comply with the specified requirements.

Tensile strength and modulus, $E_t$, is determined in accordance with ISO 3268-1978. The test specimens should be taken in two directions.

Flexural strength and modulus, $E_b$, is determined in accordance with ISO 178-1975. The test specimens should be taken in two directions.

The mean value of the results from the required tests is to comply with the stipulated requirements. No single value is to be lower than 80% of the value used as basis for determination of scantlings.

Mechanical properties of sandwich core materials

For hull structural applications, core material of Grade 1 is required. For other applications Grade 2 may be accepted.

It shall be verified by shear testing in accordance with ISO 1922 or ASTM C 273-61 that the bond between skin and core and between individual core elements have at least the same shear strength as specified for the core material in question.

The shear strength and modulus of core materials are to be specified and verified by testing in accordance with the above standards.

Global strength

The local strength requirements normally provide scantlings which satisfy the minimum global strength standard.

For vessels with large deck openings, a low depth to length ratio or large concentrated loads it may be necessary to check the midship section modulus.

The midship section modulus should not be less than:

$$Z = 53 \cdot Lh^2 \cdot B_s \cdot f_s \cdot (C_0 + 0.7) \quad (\text{cm}^3)$$

$C_0$ is not to be taken less than 0.5.

Figure 1 Effect of openings

When calculating the moment of inertia and section modulus of the midship section, the effective sections' area of continuous longitudinal strength members is in general the net area after deduction of openings.

Superstructures which do not form a strength deck are not to be included in the net section. This applies also to deckhouses and bulwarks.
The effect of openings are assumed to have longitudinal extensions as shown by the shaded areas in Fig. 1, i.e. inside tangents at an angle of 30° to each other. Example for transverse section III:

$$b_{LT} = b' + b'' + b'''$$

For twin hull vessels the effective breadth of wide decks without longitudinal bulkhead support will be considered.

### 200 Structural arrangement

#### 210 Bottom structures

211 The bottom single skin or sandwich panels shall comply with the requirements given in 300 and 400. The local strength of the keel shall be sufficient to withstand loads in connection with docking attachment of external ballast keel, etc.

212 Bottom structures may be longitudinally or transversely stiffened.

213 In planning craft single bottom as well as double bottoms are normally to be longitudinally stiffened in single skin constructions. In craft with sandwich construction transverse stiffening may be accepted.

The longitudinals should preferably be continuous through transverse members. At their ends longitudinals are to be fitted with brackets or to be tapered out beyond the point of support.

Longitudinal stiffeners are to be supported by bulkheads and/or web frames.

214 Displacement vessels with single bottom and transverse frames are to have floors at each frame. The floors are to be continuous from side to side. The scantlings of the floors may be taken in accordance with Table 1 with notes. The table values are applicable when the distance between transverse bulkheads or other equivalent support for the longitudinal girders does not exceed the breadth of the vessel. If the girder span is greater than the breadth of the vessel, the floors web plate height and flange area are to be increased as stated in the table’s note 3. Alternatively, the scantlings of the floors shall be established in accordance with 500.

215 Longitudinal girders are to be carried continuously through bulkheads. In craft built in sandwich construction longitudinal girders may be fitted to support the bottom panels.

A centre girder is to be fitted for docking purpose if the external keel or bottom shape does not give sufficient strength and stiffness.

Openings should not be located at ends of girders without due consideration being taken to shear loadings.

The scantlings of longitudinal girders may be taken in accordance with Table 2 or alternatively according to 500.

216 Main engines are to be supported by longitudinal girders with suitable local reinforcement to take the engine and gear mounting bolts. Rigid core materials to be applied in all through bolt connections.

217 Web frames are to be continuous around the cross section of the craft, i.e. web- and flange laminates of floors, side webs and deck beams are to be efficiently connected together. If intermediate floors are fitted, their ends should be well tapered or connected to local panel stiffening.

In the engine room, floors are to be fitted at every frame. The floors are preferably to be carried continuously through the engine girders. In way of thrust bearings additional strengthening is to be provided.

218 In double bottoms, manholes are to be made in the inner bottom, floors and longitudinal girders to provide access to all parts of the double bottom. The vertical extension of openings is not to exceed one half of the girder height. Exposed edges of openings in sandwich constructions are to be sealed with resin impregnated mat. All openings are to have well-rounded corners.

219 Vessels built in sandwich construction and with

$$\frac{V}{\sqrt{Lh}} > 4.5$$

shall have the fore stem designed so that a local impact at or below the waterline will not result in skin laminate peeling due to hydraulic pressure. The vertical extension of the collision protection shall be from the keel to a point 0.03 Lh (m) above the waterline at operating speed.

#### 220 Side structures

221 The hull sides may be longitudinally or vertically stiffened. The continuity of longitudinals is to be as required for bottom and deck longitudinals respectively.

222 The single skin or sandwich panels of the hull sides shall comply with the requirements of 300 and 400.

223 Vertical side frames shall normally be connected to floors and deck beams with well rounded transitions and a continuous flange laminate.

#### 230 Transom structure

231 The scantlings of transom not subjected to loads from engine or rudder installations shall comply with the requirements of 300 and 400.

232 Thrust bearing transom for outboard engine or stern drive mounting is preferable to be built as a sandwich panel with a core of waterproof plywood or equivalent material. The thickness of the transom for engine power specified by the manufacturer, should not be less than given in the table.
### Engine power (kW)

<table>
<thead>
<tr>
<th>Engine power (kW)</th>
<th>Total thickness of transom (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Outboard mounting</td>
</tr>
<tr>
<td>- 3</td>
<td>12</td>
</tr>
<tr>
<td>3 - 7</td>
<td>15</td>
</tr>
<tr>
<td>7 - 18</td>
<td>25</td>
</tr>
<tr>
<td>18 - 30</td>
<td>30</td>
</tr>
<tr>
<td>30 - 60</td>
<td>35</td>
</tr>
<tr>
<td>60 - 95</td>
<td>40</td>
</tr>
<tr>
<td>Over 95</td>
<td>Scantlings to be specially considered in each individual case.</td>
</tr>
</tbody>
</table>

The inner laminate on the core is normally to have a thickness not less than 0.7 times the thickness of the side laminate, and the outer laminate a thickness not less than 0.7 of the bottom laminate. The inner laminate is to extend forward along the sides and the bottom of the boat, and is to be gradually tapered in thickness.

#### 240 Deck structure

241 Decks may be longitudinally or transversely stiffened.

242 Deck panels of single skin or sandwich construction shall comply with the requirements of 300 and 400.

243 Decks of single skin construction in vessels with length above 24 m shall normally be longitudinally stiffened.

244 Longitudinals should preferably be continuous through transverse members. At their ends longitudinals are to be fitted with brackets or be tapered out beyond the point of support.

245 Bulwark sides are considered to be a part of the hull side and shall have scantlings accordingly. A strong flange is to be made along the upper edge of the bulwark. Bulwark stays are to be arranged in line with transverse beams or local stiffening. The stays are to have sufficient width at deck level. If the deck is of sandwich construction, solid core inserts are to be fitted at the foot of the bulwark stays. Stays of increased strength are to be fitted at ends of bulwark openings. Openings in bulwarks should not be situated near the ends of superstructures.

#### 250 Bulkhead structures

251 The scantlings of bulkhead structures shall comply with the requirements of 300 and 400.

252 Number and location of transverse watertight bulkheads are to be in accordance with the requirements given for the various vessel types specified in Pt.4.

253 Bulkheads supporting decks are to be regarded as pillars. The buckling strength will be considered in each individual case.

#### 260 Superstructures and deckhouses

261 The scantlings of superstructures and deckhouses shall comply with the requirements of 300 and 400.

262 Superstructure is defined as a decked structure on the freeboard deck, extending from side to side of the ship of with the side plating not inboard of the shell plating more than 4% of the breadth (Bs).

263 Deckhouse is defined as a decked structure above the strength deck with the side plating being inboard of the shell plating more than 4% of the breadth (Bs).

Long deckhouse is deckhouse having more than 0.2 Lh, of its length within 0.2 Lh amidships.

Short deckhouse is a deckhouse not defined as a long deckhouse.

264 In superstructures and deckhouses, the front bulkhead is to be in line with a transverse bulkhead in the hull below or be supported by a combination of girders and pillars. The after end bulkhead is also to be effectively supported. As far as practicable, exposed sides and internal longitudinal and transverse bulkheads are to be located above girders and frames in the hull structure and are to be in line in the various tiers of accommodation. Where such structural arrangement is not possible, there is to be other effective support.

265 Sufficient transverse strength is to be provided by means of transverse bulkheads or girder structures.

266 At the break of superstructures, which have not set-in from the ship's side, the side plating is to extend beyond the ends of the superstructure, and is to be gradually reduced in height down to the deck or bulwark. The transition is to be smooth and without local discontinuities.

267 In long deckhouses, openings in the sides are to have well-rounded corners. In deckhouses of single skin construction horizontal stiffeners are to be fitted along the upper and lower edge of large openings for windows. Openings for doors in the sides are to be substantially stiffened along the edges.

268 Casings supporting one or more decks above are to be adequately strengthened.
Table 1 Floors in Single Bottom

Notes to Table 1:
1. For frame spacings differing from those indicated in the table, the values for web thickness and flange area are corrected in proportion to the frame spacings.
2. In vessels with rise of floor amidships greater than half the rule height of the floor, the flange area may be reduced by 40 H/d\%.
H/d = rise of floor amidships/draught to lower side of bottom laminate at centre.
3. When the span l of centre girder is greater than the breadth Bs of the vessel, the values for flange area and web thickness of floors are multiplied by a factor f1 taken from the following table.

<table>
<thead>
<tr>
<th>( \frac{l}{Bs} )</th>
<th>1,10</th>
<th>1,25</th>
<th>1,50</th>
<th>2,00</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f_1 )</td>
<td>1,13</td>
<td>1,25</td>
<td>1,37</td>
<td>1,50</td>
</tr>
</tbody>
</table>

4. Web thickness \( t_w \) is measured as shown in the sketch in 525.

End of note

Centre Girder

\[
\frac{\text{Flange area in cm}^2/\text{web thickness in mm}}{\text{Bs}} = \begin{array}{cccccc}
0.5 & 3,0/6,0 & 3,0/5,0 & 8,6/10,0 & 8,6/12,0 & 18,0/13,0 \\
1,0 & 3,5/6,0 & 3,6/8,3 & 11,9/12,2 & 14,0/15,0 & 23,0/15,2 \\
1,5 & 5,0/8,0 & 5,0/11,0 & 15,5/17,5 & 18,4/19,6 & 27,0/18,0 \\
2,0 & 6,1/13,3 & 6,0/15,0 & 18,4/19,6 & 31,0/20,4 & 35,0/22,3 \\
2,5 & 7,0/35,2 & 15,5/17,5 & 46,0/21,0 & 41,0/18,7 \\
3,0 & 7,9/35,2 & 18,4/19,6 & 31,0/20,4 & 46,0/21,0 & 51,0/23,0 \\
3,5 & 11,9/12,0 & 18,4/19,6 & 31,0/20,4 & 46,0/21,0 |
\end{array}
\]

Bs = breadth of vessel in metres
d = draught in metres to lower side of bottom laminate

Table 2 Longitudinal Bottom Girders

Note:
For girder spans greater than vessel's breadth, the values for flange area and web thickness of the girder are multiplied by the factor \( f_2 \) given in note 3 to Table 1.

Side Girders

\[
\text{Flange area} = f_2 \times \text{flange area of centre girder.}
\]

\[
\text{Web thickness} = 0.9 \times \text{web thickness of centre girder.}
\]

End of note

300 Single skin constructions

310 General

311 In this section the general requirements for the local strength of stiffened single skin constructions are given.

312 Buckling strength of single skin panels subjected to longitudinal hull girder or local compression loads will be individually considered.

320 Laminate thickness

321 The thickness of structural laminates, excluding topcoat and gelcoat, shall be not less than the largest value found from the following formula:

\[
t_{\text{min}} = (t_0 + klH) \sqrt{f_b} \quad (\text{mm})
\]

\[
t_p = k_p \cdot f_1 \cdot \sqrt{p} \quad (\text{mm})
\]

\( t_0 \) and \( k \) are given in the table in 322.

\( f_1 \) is given in 131.
\( f_p \) is given in 323.

\[ k_p = 3.82 \text{ for bottom panels} \]
\[ = 4.73 \text{ for side panels} \]
\[ = 4.11 \text{ for panels elsewhere and for all stiffening members.} \]

\[ k_p = 3, 82 \text{ for bottom panels} \]
\[ = 4, 73 \text{ for side panels} \]
\[ = 4 , \text{J} \text{ for panels elsewhere and for all stiffening members.} \]

322 \( t_0 \) and \( k \) are to be taken according to the following table:

<table>
<thead>
<tr>
<th></th>
<th>( \text{Lh} \leq 15 \text{ m} )</th>
<th>( \text{Lh} &gt; 15 \text{ m} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hull bottom</td>
<td>2.5, 0.58k(_d), 8.6, 0.17</td>
<td>2, 0.58k(_d), 8.1, 0.17</td>
</tr>
<tr>
<td>Hull side</td>
<td>2.0, 0.58k(_d)</td>
<td>2.0, 0.58k(_d)</td>
</tr>
<tr>
<td>Transom, not</td>
<td>2.0, 0.58k(_d)</td>
<td>2.0, 0.58k(_d)</td>
</tr>
<tr>
<td>thrust bearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed deck</td>
<td>1.7, 0.42</td>
<td>6.8, 0.08</td>
</tr>
<tr>
<td>Cargo deck</td>
<td>1.7+0.\text{H}, 0.42</td>
<td>7.3, 0.08</td>
</tr>
<tr>
<td>Acr. deck</td>
<td>1.7, 0.42</td>
<td>6.8, 0.08</td>
</tr>
<tr>
<td>Supersn. and</td>
<td>1.7, 0.42</td>
<td>6.8, 0.08</td>
</tr>
<tr>
<td>deckhouses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural/</td>
<td>1.1, 0.42</td>
<td>6.2, 0.08</td>
</tr>
<tr>
<td>watertight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bulkheads</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( \Delta = \text{deck cargo in } \text{t/m}^2 \).

\[ k_d = \sqrt{\frac{\Delta}{\Delta_{\text{max}}}} \];\hspace{1cm} \text{applies only to recreational crafts}\]

\[ \Delta_{\text{max}} = (12 \cdot \text{Lh} \cdot \text{Bs})^{1.5} \text{ (kg)} \]

\[ k_v = 0.86 + 0.014 \text{V} \].

323 The combined correction factor, \( f_p \), is given by:

\[ f_p = f_{p1} \cdot f_{p2} \cdot \sqrt{t_0} \]

The aspect ratio correction, \( f_{p1} \), is to be taken from the diagram in Figure 2:

\[ f_{p1} \]

\[ 1.00 \]

\[ 0.75 \]

\[ 0.25 \]

\[ 0.00 \]

\[ \text{a and } s \text{ are the longest and shortest panel edge respectively.} \]

The panel curvature correction, \( f_{p2} \), is to be taken as

\[ f_{p2} = 1 - h/s, \text{ h and } s \text{ defined in Figure 3} \]

\[ f_{p2\min} = 0.8 \]

\[ f_{p1} \]

\[ 1.00 \]

\[ 0.75 \]

\[ 0.25 \]

\[ 0.00 \]

\[ \text{Figure 2} \text{ Aspect ratio correction factor } f_{p1} \]

324 Reduced thicknesses may be accepted provided equivalent impact resistance can be documented.

330 Local laminate reinforcement

331 The structural laminates shall locally be reinforced to a thickness not less than:

\[ t_{\text{min}} = (t_0 + k \cdot \text{Lh}) \cdot \sqrt{t_0} \text{ (mm)} \]

\[ t_0 \text{ and } k \text{ are given in the following table:} \]

<table>
<thead>
<tr>
<th></th>
<th>( \text{Lh} \leq 15 \text{ m} )</th>
<th>( \text{Lh} &gt; 15 \text{ m} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keel type 1 and 2</td>
<td>2.9, 0.9(_k), 14.5, 0.14</td>
<td></td>
</tr>
<tr>
<td>Keel type 3</td>
<td>3.5, 1.1(_k), 17.5, 0.17</td>
<td></td>
</tr>
<tr>
<td>Fore and aft stem</td>
<td>2.9, 0.9(_k), 14.5, 0.14</td>
<td></td>
</tr>
<tr>
<td>Chine and transom</td>
<td>2.4, 0.7(_k), 12.0, 0.11</td>
<td></td>
</tr>
<tr>
<td>corners (^*)</td>
<td>3.5, 1.1(_k), 17.5, 0.17</td>
<td></td>
</tr>
</tbody>
</table>

\(^*\) \text{Breadth to each side shall be } 25 \cdot \text{Bs (mm), not less than } 100 \text{ mm} \]

Extension of keel laminate is shown in Figure 4.

\[ f_{p1} \]

\[ 1.00 \]

\[ 0.75 \]

\[ 0.25 \]

\[ 0.00 \]

\[ f_{p1} \]

\[ f_{p2} \]

\[ t_{\text{min}} \]

\[ t_0 \]

\[ k \]

\[ \text{Keel type 1} \]
Sandwich constructions

410 General

411 In this section the general requirements for the local strength of sandwich constructions are given.

412 Buckling strength of sandwich constructions subjected to longitudinal hull girder or local compression loads will be individually considered.

420 Panel requirements

421 The thickness of skin laminates of sandwich panels shall not be less than:

\[
t_{\text{min}} = \frac{k \cdot t_{\text{min}}}{f_c} \quad (\text{mm})
\]

where \(t_{\text{min}}\) is minimum thickness found from 321.

\[f_c = 0.94 + 0.12 \sigma_c\]

where \(\sigma_c\) is compressive strength of the core material in N/mm².

422 The section modulus and moment of inertia of a 1 cm wide panel strip shall be not less than:

\[
W = 0.04 \cdot f_w \cdot p \cdot s^2 \quad (\text{cm}^3)
\]

\[
I = 0.0364 \cdot f_i \cdot p \cdot s^3 \quad (\text{cm}^4)
\]

The correction factors for panel aspect ratio, \(f_w\) and \(f_i\), are found from the diagram in Figure 5:

423 The correction factor for laminate strength, \(f_n\), is given in 131.

The correction factor for laminate stiffness, \(f_{n2}\), is to be taken as

\[
f_{n2} = \frac{7000}{E_n}
\]
The stiffness factor, $f_{st}$, is to be taken as $f_{st} = 1.0$ for decks and floor panels $= 0.5$ elsewhere.

If the stiffness of the panel is increased due to curvature, a lower moment of inertia may be accepted.

$W$ and $I$ properties for panels with skin laminates of equal thicknesses are given in 425.

423 The shear strength of the core material shall be not less than:

$$\tau_u = \frac{1.5 \cdot f_{T1} \cdot p \cdot s}{d} \text{ (MPa)}$$

For core materials in bottom panels of planning craft documentation of dynamic properties of the material may be required.

The shear strength of bottom panels is not to be less than $0.04 \cdot V$ MPa, minimum $0.7$ MPa.

The shear strength of other panels is not to be less than $0.4$ MPa.

The thickness of the core is not to be less than $10 \cdot s$ (mm).

$d$ = panel thickness in mm measured as distance between the centreline of the skin laminates as shown in 425.

The correction factor for panel aspect ratio, $f_{T1}$, is found from the diagram in Figure 6:

$$f_{T1}$$

$1.00$ $0.95$ $0.90$ $0.85$ $0.80$ $0.75$ $0.70$ $0.65$ $0.60$ $0.55$ $0.50$ $0.45$ $0.40$ $0.35$ $0.30$ $0.25$ $0.20$ $0.15$ $0.10$ $0.05$ $0.00$

$a/b$

Figure 6 Aspect ratio correction factor $f_{T1}$.

424 Reduced thicknesses may be accepted provided equivalent impact resistance can be documented.

425 Section modulus $W$ and moment of inertia $I$ of a $1$ cm wide sandwich panel with skin laminate of equal thicknesses, are given in the Figures 7, 8 and 9, as a function of core thickness $K$ and skin laminate thickness $t$.

Figure 7 Definition of laminate dimensions.

Figure 8 Section modulus $W$. 

Figure 9 Moment of inertia $I$. 

Figure 10 Elastic modulus $E$. 

Figure 11 Thermal conductivity $\lambda$. 

Figure 12 Thermal diffusivity $\delta$. 

Figure 13 Electrical conductivity $\sigma$. 

Figure 14 Electrical resistivity $\rho$. 

Figure 15 Thermal conductivity $\lambda$. 

Figure 16 Electrical conductivity $\sigma$. 

Figure 17 Thermal diffusivity $\delta$. 

Figure 18 Electrical resistivity $\rho$. 

Figure 19 Thermal conductivity $\lambda$. 

Figure 20 Electrical conductivity $\sigma$. 

Figure 21 Thermal diffusivity $\delta$. 

Figure 22 Electrical resistivity $\rho$. 

Figure 23 Thermal conductivity $\lambda$. 

Figure 24 Electrical conductivity $\sigma$. 

Figure 25 Thermal diffusivity $\delta$. 

Figure 26 Electrical resistivity $\rho$.
430 Local panel reinforcements

The sandwich panel skin laminates shall locally be reinforced to a thickness not less than:

\[ t_{\text{min}} = \frac{k \cdot t_{\text{min}}}{f_c} \text{ (mm)} \]

\[ t_{\text{min}} = \text{minimum thickness according to 330} \]

\[ f_c = 0.94 + 0.12 \sigma_c \] where \( \sigma_c \) is compressive strength of the core material in N/mm\(^2\)

\( k \) is found from the table below:

<table>
<thead>
<tr>
<th>Keel type 1 and 2</th>
<th>Exposed (^d)</th>
<th>Protected (^d)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Keel type 3</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Fore and aft stem</td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Chine and transom corners (^a)</td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Bottom lam. in way of rudder stock, shaft brackets, etc.</td>
<td>0.4</td>
<td>0.3</td>
</tr>
</tbody>
</table>

1) The term exposed means a side of a panel which is subject to permanent liquid submergence or which can be exposed to local mechanical abrasive or impact loads.

2) The term protected means a side of a panel that is not subject to loads as described above.

\(^a\) Breadth to each side shall be 25 \( \cdot \) Bs (mm), not less than 100 mm

500 Frames, beams and other stiffeners

510 General

511 In this section the general requirements for the strength of laterally loaded frames, beams and other stiffeners in single skin and sandwich constructions are given.

512 Stiffening profiles are normally to be attached to the base panel by secondary bonding.

513 Where continuous stiffening profiles of the same height and built with a weak core material, are crossing each other load bearing core inserts may be required to provide sufficient shear strength.

520 Section modulus

521 The section modulus of stiffening members is not to be less than:

\[ W = 4,0 \cdot m \cdot f_a \cdot p \cdot b \cdot l^2 \quad (\text{cm}^3) \]

\[ I = 36,4 \cdot d \cdot f_i \cdot p \cdot b \cdot l^2 \quad (\text{cm}^4) \]

\( b = \text{load breadth in metres} \)

\( l = \text{stiffener span in metres for curved frames, see 522} \)

m- and d-values for the most common structural members are found from the table in 523.

\( f_a \) and \( f_i \) are given in 524.

522 For concave frames the length \( l \) determining the scantlings is given by:

\[ l = l_0 - 3 f + 0.3 R \quad \text{metres} \]

\( l_0 = \text{length in metres of the straight part of the frame in bottom} \)

When the bilge radius is constant, \( l_0 \) is measured as shown in Figure 10A. When the radius varies, \( l_0 \) is measured as shown in Figure 10B.
R = bilge radius in metres.

Figure 10A

Figure 10B

Figure 10 Length for determination of scantlings, concave frames

For S-shaped frames the length which determines scantlings is measured as shown in Fig. 11.

Figure 11 Length for determination of scantlings, S-shaped frames

523 The m- and d-values are normally to be taken as follows for the various structural members:

<table>
<thead>
<tr>
<th>Item</th>
<th>m</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous longitudinals</td>
<td>0.85</td>
<td>0.4</td>
</tr>
<tr>
<td>Non-continuous longitudinals</td>
<td>1.00</td>
<td>1.0</td>
</tr>
<tr>
<td>Transverse</td>
<td>1.00</td>
<td>1.0</td>
</tr>
<tr>
<td>Vertical members, ends fixed</td>
<td>1.00</td>
<td>1.0</td>
</tr>
<tr>
<td>Vertical members, simply supported</td>
<td>1.35</td>
<td>2.0</td>
</tr>
<tr>
<td>Bottom longitudinal</td>
<td>0.85</td>
<td>0.4</td>
</tr>
<tr>
<td>Bottom transverse</td>
<td>1.00</td>
<td>1.0</td>
</tr>
<tr>
<td>Side longitudinal</td>
<td>0.85</td>
<td>0.4</td>
</tr>
<tr>
<td>Side vertical</td>
<td>1.00</td>
<td>1.0</td>
</tr>
<tr>
<td>Deck longitudinal</td>
<td>0.85</td>
<td>0.4</td>
</tr>
<tr>
<td>Deck transverse</td>
<td>1.00</td>
<td>1.0</td>
</tr>
<tr>
<td>W.T. bulkhead, fixed ends</td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td>W.T. bulkhead, fixed one end</td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>W.T. bulkhead, simply supported ends</td>
<td>1.25</td>
<td></td>
</tr>
<tr>
<td>Tank and cargo bulkheads, fixed ends</td>
<td>1.00</td>
<td>1.0</td>
</tr>
<tr>
<td>Tanks and cargo bulkheads, simply supported ends</td>
<td>1.35</td>
<td>2.0</td>
</tr>
<tr>
<td>Deckhouse stiffener</td>
<td>1.00</td>
<td>1.0</td>
</tr>
<tr>
<td>Casings</td>
<td>1.00</td>
<td>1.0</td>
</tr>
</tbody>
</table>

524 The correction factors for laminate properties are to be taken as follows:

\[ f_a = \frac{80}{\sigma_{ba}} \quad f_i = \frac{7000}{E_a} \]

If the various parts of the stiffener, including the plate flange, have different strength and stiffness "equivalent sectional areas" shall be used when calculating the section modulus of the stiffener.
The "equivalent sectional area" is found by multiplying the actual area with the stiffness ratio \( \frac{E_\alpha}{E_r} \). A condition for employing this method is that the strength ratio \( \frac{\sigma_\alpha}{\sigma_r} \) is not less than the stiffness ratio above.

\[ E_\alpha \sigma_\alpha = \text{tensile modulus and strength respectively of the laminate considered.} \]

\[ E_r \sigma_r = \text{tensile modulus and strength respectively of the reference laminate for which the section modulus requirement is calculated.} \]

525 Section modulus \( W \) for profiles with panel as function of flange area \( A_\alpha \), core height \( H \) and web thickness \( t_w \) (as given in Figure 12) is given by the graphs in Figure 13 and Figure 14.

**Figure 12** Definition of \( A_\alpha \), \( H \) and \( t_w \).

**Figure 13** Section modulus \( W \) of profiles

526 Section modulus \( W \) of skin laminate steps as function of step height \( H \) and laminate thickness \( t \) (as defined in Figure 15) is given by the graphs in Figure 16.

**Figure 14** Section modulus \( W \)

**Figure 15** Definition of \( H \) and \( t \)

**Figure 16** Section modulus \( W \) of skin laminate steps
# TENTATIVE RULES FOR CERTIFICATION AND CLASSIFICATION OF BOATS

## STRUCTURAL DESIGN

### PART 3 CHAPTER 4

## THERMOPLASTIC CONSTRUCTIONS

### DECEMBER 1997

## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>General</td>
<td>3</td>
</tr>
<tr>
<td>110</td>
<td>Premises</td>
<td>3</td>
</tr>
<tr>
<td>120</td>
<td>Marking of produced boats</td>
<td>3</td>
</tr>
<tr>
<td>200</td>
<td>Rotation moulding of polyethylene boats</td>
<td>3</td>
</tr>
<tr>
<td>210</td>
<td>Moulding condition</td>
<td>3</td>
</tr>
<tr>
<td>220</td>
<td>Moulded boats</td>
<td>3</td>
</tr>
<tr>
<td>230</td>
<td>Internal control</td>
<td>3</td>
</tr>
<tr>
<td>300</td>
<td>Thermoforming of abs-sheets</td>
<td>3</td>
</tr>
<tr>
<td>310</td>
<td>Forming of sheets</td>
<td>3</td>
</tr>
<tr>
<td>320</td>
<td>Internal control of the boat manufacturing</td>
<td>4</td>
</tr>
<tr>
<td>400</td>
<td>Boat construction</td>
<td>4</td>
</tr>
<tr>
<td>410</td>
<td>Design</td>
<td>4</td>
</tr>
<tr>
<td>420</td>
<td>Assembly</td>
<td>4</td>
</tr>
<tr>
<td>430</td>
<td>Rule thickness</td>
<td>4</td>
</tr>
<tr>
<td>500</td>
<td>Polyethylene</td>
<td>4</td>
</tr>
<tr>
<td>510</td>
<td>Manufacturing</td>
<td>4</td>
</tr>
<tr>
<td>520</td>
<td>Scantlings, LDPE and MDPE</td>
<td>4</td>
</tr>
<tr>
<td>530</td>
<td>Surveillance of the production</td>
<td>5</td>
</tr>
<tr>
<td>600</td>
<td>Acrylnitributadienestyrene (abs) and equivalent materials</td>
<td>5</td>
</tr>
<tr>
<td>610</td>
<td>Manufacturing conditions</td>
<td>5</td>
</tr>
<tr>
<td>620</td>
<td>Material requirements</td>
<td>5</td>
</tr>
<tr>
<td>630</td>
<td>Scantlings</td>
<td>5</td>
</tr>
<tr>
<td>640</td>
<td>Surveillance of the production</td>
<td>5</td>
</tr>
</tbody>
</table>
FOREWORD

Det Norske Veritas is a free-standing, autonomous and independent Foundation with the object of safeguarding life, property and the environment at sea and ashore.

Det Norske Veritas AS, a fully owned subsidiary Society of the Foundation, undertakes classification and certification and secures the quality of ships, mobile offshore units and fixed offshore installations, facilities and systems, and carries out research in connection with these functions. Moreover, the Society, provided its integrity is not impaired, may perform assignments which utilize its knowledge or which contribute to develop knowledge that will be required for the performance of these assignments.

The Foundation was established in 1978 as a direct continuation of the association The Norske Veritas which was established in 1864.

This new rule booklet was approved by the Board in August 1997.
100 General

110 Premises

111 Premises for manufacturing of boats of thermoplastics are to be suitable for the production process applied.

112 Uncontrollable draughts are to be avoided in the vicinity of the production machinery and in cooling rooms.

113 Premises and production machinery are to be arranged to avoid risk of pollution by oil spill, dust etc.

120 Marking of produced boats

121 If the applied structural material has properties of significance for the use of the boat which differ from the standard given for boats of glassfibre-reinforced polyester, appropriate information will be given on the certificate.

122 The boat is to have a durably fitted plate or similar which clearly states the structural material of the boat.

123 The boat manufacturer shall supply the following with each boat: information on the boat's presupposed use, directions for maintenance and repair as well as information on substances which may have detrimental effects on the boat's structural material.

200 Rotation moulding of polyethylene boats

210 Moulding condition

211 Release compositions applied to the mould are not to have any detrimental effects on the boat material, e.g. stress cracking.

212 Regenerated raw material will not be accepted for use in hulls manufactured by rotation moulding.

213 The rotation procedure is to be the same for moulding of all boats of the same type.

214 The weight quantity of powder in the mould is not to be less than 1% below the specified value.

215 The temperature is to be automatically controlled. The temperature and its specified permissible variations will be subject to approval in each case, on the basis of the limitations of the raw material properties. The temperature at each measuring point is not to vary by more than 50C for each moulding process.

216 The sintering time and the after-sintering time is stipulated on the basis of thickness measurements on the boat type in question to ensure that an even distribution of material in the mould is obtained. The process time is not to vary by more than + 1 minute from the approved time. Any welding together of inner and outer mould is to be approved in each separate case.

217 The cooling-down process is to be the same for each boat of the same type, and will be stipulated on the basis of the sintering temperature, boat type and raw material, so that deformations in the material are avoided.

218 If alterations are made in the manufacturing method, the Society is to be informed for considering whether special tests will be required to check the material quality.

220 Moulded boats

221 The material in the finished moulded boats is to be without any visible surface flaws of significance to the boat's service. Surfaces and cross sections are not to show any sign of either insufficient fusion of the powder particles or thermal degradation of the material.

222 Pores or air bubbles are not to be so numerous or of such size that the material properties are significantly reduced. The amount and size allowed shall be stipulated for each type of material.

223 The material in the moulded boats is to comply with the requirements to minimum mechanical properties specified for the raw material in question.

224 Completed boats are not to have significant deformations, and all welded joints are to be tight.

230 Internal control

231 The boat manufacturer is to keep a journal of the raw material supplier's certificate data, and he is also to store samples from each material delivery.

232 The boat manufacturer is to record the following process data for each individual boat:

- weighed quantity of powder
- temperature
- sintering and after-sintering time
- cooling-down time.

233 Each boat is also to be visually checked for surface flaws and tightness of welded joints.

234 Each boat is to be marked with its production number, which also shall identify the mould in which the boat has been manufactured. The marking is to be made in a durable way.

235 Thickness measurements shall normally be carried out on boats that are cut into several sections. Such measurements shall be carried out on one out of 200 boats manufactured in each mould.

300 Thermoforming of abs-sheets

310 Forming of sheets

311 The forming process is to be such that the material properties are not significantly reduced during the production.
process. After checking the thickness of some completely formed boats, the thickness of the sheets to be used in production of the boat type shall be decided.

312 The temperature distribution on the sheet is to be the same for all boats formed. The temperature of the sheet and the mould is to be within the limits specified for the relevant material.

313 After forming of the hull the yield point of the material under tensile testing is not to deviate by more than 20% from the yield stress in the production direction. The mean value from 5 test specimens is to be used as a basis.

314 Stressed structural parts are to be formed without sharp edges. The radius of any curvature on the mould side is not to be less than twice the rule thickness, and on the opposite side not less than 5 times the rules thickness. Sharper edges may, however, be accepted if special reinforcements reduce the stress concentration.

320 Internal control of the boat manufacturing

321 The boat manufacturer is to keep a journal of the sheet supplier's certificate data.

322 Each thermoformed sheet is to be visually checked for surface flaws.

323 At positions agreed with the Surveyor, the skin thickness on the boats in production is to be checked by measurement at least once a day, and at least once for every 50 boats. The results are to be recorded.

400 Boat construction

410 Design

411 The design of the boat is to be suitable for the manufacturing process and the raw material being used.

412 When forming boats of thermoplastics, it is to be taken into consideration that the mechanical properties of the material vary with the temperature and the duration of the loading.

413 Hard points in the structure are as far as practicable to be avoided. Stiffening is to be evenly distributed over the hull, to the extent this is practicable.

414 The design is to be such that sufficient hull stiffness is obtained. Large flat surfaces are to be avoided as far as practicable.

420 Assembly

421 No materials built into the boat are to have detrimental effects on the other materials applied.

422 The skins in double hulled constructions and in sandwich constructions are to be watertight. Screws or bushings in the skins shall be watertight.

423 Where exposed, the connection between inner and outer skin is to be watertight.

430 Rule thickness

431 Rule thickness is the value stated in the Rules.

432 A measured thickness is regarded as satisfactory when the average of the values measured at 20 points is not less than the rule thickness and if none of the values measured at the individual points is more than 15% below rule thickness.

433 Local reinforcements that are welded or glued to the hull, may upon special consideration be regarded as part of the skin thickness.

500 Polyethylene

510 Manufacturing

511 Requirements to moulding time, temperatures and cooling time are determined based on quantity of powder used and the rotation speed, on the background of inspection of complete moulded boats.

512 Raw materials should be approved in accordance with Pt.7 Ch.1.

513 If the boat manufacturer himself wishes to grind granulate to powder, the grinding and sieving equipment are first to be approved by the Society.

514 A pigment of approved type and in the approved quantity is to be added to the powder. During or after the grinding the powder is to be sifted through a mesh of not more than 800 µ.

515 Material moulded in accordance with the boat manufacturer's actual procedure shall at least have properties as given in table 600.2 in Pt.7 Ch.1.

520 Scantlings, LDPE and MDPE

521 The thickness of the outer hull bottom and side is not to be less than:

\[ t_y = k \cdot \frac{s}{Lh} \sqrt{PF} \left( t4 + 3,6 \times Lh \right) \text{ mm} \]

where

- \( k = 1,0 \) for LDPE
- \( k = 0,85 \) for MDPE
- \( s = \) stiffener spacing in meter
- \( PF = \) pressure factor for bottom, respectively side, taken from figures in Pt.3 Ch.1 220 and Pt.3 Ch.1 230.

522 The thickness of the inner hull is not to be less than:

\[ t_i = 0,8 \cdot t_y \text{ mm} \]
523 Rotation moulded boats should have a hull weight of at least k·45 kg. The boat should be stiffened in such a way that keel, bottom or side sheets are not to be deformed or displaced by normal load without reducing the usage of the boat.

524 Transom for engine mounting is normally to be stiffened over its full breadth. Scantlings based on practical testing with simulated loads from the engine may be accepted.

530 Surveillance of the production

531 Moulding time, temperature, density and meltindex of the materials shall be recorded.

532 The inner surfaces and weldings are to be visually inspected and the hull thicknesses measured by cutting various sections of the boat.

600 Acrylnitrilbutadienestyrene (ABS) and equivalent materials

610 Manufacturing conditions

611 Requirements to forming temperature and sheet thickness are determined for each boat type on the basis of inspection of completed boats.

620 Material requirements

621 Raw materials shall be approved according to Pt. 7 Ch. 1.

622 Material tests are carried out on sheets produced with low internal stresses and low orientation. When testing the shrinkage of the sheet, the test specimens are to be heated to 150°C.

623 When using foam in structural members, the following requirements are to be complied with:

<table>
<thead>
<tr>
<th>Properties</th>
<th>Requirements Foam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive strength</td>
<td>0.4 N/mm²</td>
</tr>
<tr>
<td>Shear strength</td>
<td>0.4 N/mm²</td>
</tr>
<tr>
<td>Connection skin/core</td>
<td>Fracture in glued joints is not to occur</td>
</tr>
</tbody>
</table>

630 Scantlings

631 The following scantling requirements are based on a boat speed not exceeding 10 knots.

632 Thickness of outer hull:

The bottom thickness is not to be less than:

\[ t_b = 1.5 + 0.4 \, \text{Loa} + 0.06 \, V \, \text{mm} \]

\[ t_{b, \text{min}} = 2.6 \, \text{mm} \]

633 The side thickness is not to be less than:

\[ t_s = 1.5 + 0.4 \, \text{Loa} \, \text{mm} \]

\[ t_{s, \text{min}} = 2.4 \, \text{mm} \]

634 The thickness of the inner hull is not be less than:

\[ t_i = 0.9 \, t_s \, \text{mm} \]

\[ t_{i, \text{min}} = 2.2 \, \text{mm} \]

635 If the boat is intended for a speed exceeding 10 knots, the material thickness will be considered in relation to the stiffening system and the boat speed in each case.

636 Boats built in accordance with the above requirements are to have at least one longitudinal stiffening or the equivalent. The need for any additional stiffening will be considered in each case.

637 The transom is normally to be stiffened over its full breadth if use of outboard engine is intended. Scantlings based on practical testing with simulated loads from the engine, may be accepted.

638 All stiffenings are to be of such shape that stress concentrations are avoided as far as practicable.

640 Surveillance of the production

641 The yield stress of the material before and after forming is checked by random sample testing.

642 By random sample testing at the raw material manufacturer the sheet thickness, shrinkage, and impact strength tested with drop weight shall be checked.
PART 4 CHAPTER 1

RECREATIONAL CRAFT

DECEMBER 1997

CONTENTS

100 General requirements ............................................. 3
110 Application .......................................................... 3
120 Additional class notation ......................................... 3
130 Technical documentation ......................................... 3
140 Definitions .......................................................... 4
150 Boat design categories ........................................... 7
160 Hull identification number ....................................... 7
170 Builder's plate ...................................................... 8
180 Owner's manual .................................................... 8
200 Integrity ................................................................ 8
210 Stability and freeboard ........................................... 8
220 Buoyancy and flotation ........................................... 9
230 Openings in hull, deck and superstructure ................. 9
240 Flooding ................................................................ 11
250 Maximum recommended load ................................... 11
260 Swamped flotation test ........................................... 12
270 Swamped stability test ........................................... 12
300 Structural requirements .......................................... 13
310 Structure ............................................................ 13
400 Machinery and power supply .................................... 13
410 Inboard engine ...................................................... 13
420 Ventilation .......................................................... 14
430 Exposed parts ....................................................... 14
440 Outboard engines arrangement ................................. 14
450 Fuel system, general .............................................. 14
460 Fuel tanks .......................................................... 15
470 Electrical system ................................................... 15
500 Steering and manoeuvring ...................................... 16
510 Visibility .............................................................. 16
520 Steering system ..................................................... 17
530 Emergency steering arrangements ........................... 17
540 Navigation lights ................................................... 17
550 Handling characteristic ......................................... 17
560 Rated engine power ............................................... 17
600 Fire safety ........................................................... 18
610 Fire protection in general ....................................... 18
620 Fire-fighting equipment ........................................ 18
630 Gas system .......................................................... 18
700 Personal safety ...................................................... 19
710 Protection from falling overboard and means of reboarding ......................................................... 19
720 Liferaft stowage .................................................... 19
730 Escape ............................................................... 19
740 Ancreoring, mooring and towing ............................. 19
800 Discharge prevention .............................................. 20
810 Accidental spill ..................................................... 20
820 Toilets ............................................................... 20
830 Sealed shut arrangement ......................................... 20
900 Components ........................................................ 20
910 Ignition-protected equipment for inboard and stern engines ......................................................... 20
920 Start-in-gear protection devices for outboard engines ................................................................. 20
930 Steering wheels, steering mechanisms and cable assemblies .................................................... 20
940 Fuel tanks and fuel hoses ........................................ 20
950 Prefabricated hatches and portlights ........................ 20
960 CE marking .......................................................... 20

DETNORSKE VERITAS
Veritasveien 1, N-1322 Hovik, Norway
Tel.: +47 67 57 99 00 Fax: +47 67 57 99 11
FOREWORD

Det Norske Veritas is a free-standing, autonomous and independent Foundation with the object of safeguarding life, property and the environment at sea and ashore.

Det Norske Veritas AS, a fully owned subsidiary Society of the Foundation, undertakes classification and certification and secures the quality of ships, mobile offshore units and fixed offshore installations, facilities and systems, and carries out research in connection with these functions. Moreover, the Society, provided its integrity is not impaired, may perform assignments which utilize its knowledge or which contribute to develop knowledge that will be required for the performance of these assignments.

The Foundation was established in 1978 as a direct continuation of the association The Norske Veritas which was established in 1864.

This new rule booklet was approved by the Board in August 1997.

© Det Norske Veritas AS 1997

Data processed and typeset by Division Technology and Products, Det Norske Veritas AS

Printed in Norway by Det Norske Veritas AS
100 General requirements

110 Application

111 This chapter is applicable to recreational craft with main class DNV or at DNV or at DNV with length less than 24 metres.

112 The Rules in this chapter is not applicable to craft intended for operation on a commercial basis, i.e. that the operation of the craft is being financed by others than those on board. However, this chapter is applicable to charter boats.

113 Compulsory national regulations may apply to craft considered under this chapter.

Guidance note:
- Charter yachts may be subject to certification by national authorities
- Recreational craft less than 24 metres may have to comply with European Union Directive No. 94/25/EC for CE marking.

End of Guidance note

114 If a recreational craft is used for commercial purpose, the certificate based on this chapter is not valid.

120 Additional class notation

121 A vessel satisfying the following Rules is given the class notation Recreational Craft.

122 When an existing vessel is to enter class without approval or supervision during construction, the class Recreational Craft may be given on basis of survey of the vessel.

123 The additional class notation CE signifies compliance with the EU Directive for Recreational Craft. CE marking is applicable to recreational craft with hull length from 2,5 m to 24 m according to ISO 8666.

124 The text in this chapter is developed from the EU directive for Recreational Craft. Text printed in italics are quotations from the directive.

Compliance with the EU directive requirements of this chapter shall be presumed when the relevant national standards, adopted pursuant to the harmonised standards the reference of which has been published in the Official Journal of the European Communities, are applied.

Until these standards are adopted, the solutions specified in this chapter and/or in the RSG Guidelines shall be applied.

Further reference is made to Pt.1 Ch.1 125, stating that the Society may make adjustments of the requirements of Tentative Rules.

130 Technical documentation

131 The technical documentation referred to under the various certification modules in Pt.1 Ch.2 must comprise all relevant data or means used by the manufacturer to ensure that components or craft comply with the Rule requirements related to them.

The technical documentation shall enable understanding of the design, manufacture and operation of the product, and shall enable assessment of conformity with the requirements of this Chapter.

The documentation shall contain so far as relevant to assessment:
- a general description of the type
- conceptual design and manufacturing drawings and schemes of components, sub-assemblies, circuits, etc.,
- descriptions and explanations necessary for the understanding of said drawings and schemes and the operation of the product.
- a list of the ISO/CEN standards referred to in the Rules as alternative to the Rule requirements applied in full or in part,
- results of design calculations made, examinations carried out etc.,
- test reports, or calculations namely on stability according to point 210 and on buoyancy according to point 220 of this chapter.

132 The technical documentation shall comprise the information specified in the Guidance note below.

Guidance note:

Guideline for technical file

The documentation for conformity assessment shall be in accordance with EC publication Technical File (Doc. Certif. 91 /6 rev. 2), which in part states:

To allow for effective exploitation of the technical documentation, excessive paperwork shall be avoided. To achieve this and to facilitate the manufacturer task the notified bodies shall accept subdivision of the file into two parts:

a) The first part (A) shall consist of a summary of the essential technical data relevant to the conformity assessment procedures, including in particular:
- the name and address of the manufacturer and the identification of the product;
- the list of the harmonised standards followed by the manufacturer and/or the solutions adopted to satisfy the essential requirements;
- a description of the product;
- the operating instructions, if any;
- the overall plan of the product, if any.

b) The second part (B) shall consist of a full file containing all the test reports, plans, information concerning the quality
Part A
A.0 Manufacturer's name and address.
   - boat type
   - identification of the product (HIN).
A.1 Product description
   - design category
   - main particulars
   - capacities (tank volume, no. of persons, loading, max. engine, battery).
A.2 List of applied standards.
A.4 General Arrangement (lay-out).
Part B
B.1 Main drawings/specifications
   - lines drawing (mandatory for Lh > 12.0 m)
   - arrangement (interior, seating arrangements, coaming heights, closing appliances, windows, hatches, field of vision, handholds, rails, escape openings, means of reboarding, liferaft stowage point)
   - buoyancy elements, air tanks
   - hull structure (longitudinal & transverse sections and plan)
   - deck and superstructure
   - foundations
   - laminate specifications if appropriate
   - gas tight subdivision if appropriate
   - engine installation including shaft and exhaust system
   - rudder installation and steering system, including emergency system
   - fuel tanks
   - mooring/towing cleats.
B.2 System drawings/specifications
   - through hull fittings
   - fuel system
   - bilge system
   - draining of cockpits and wells
   - ventilation of engine and tank spaces
   - cooling water system (sea water)
   - electrical installations (diagrams 12/24 V - 220 V)
   - fire extinguishing systems (fixed and portable)
   - exhaust system
   - gas installations (LPG)
   - machinery space insulation
   - navigation lights
   - heater/cooking stove arrangements
   - discharge prevention of oil, fuel, human waste, etc.
B.3 Calculations
   - strength calculations
   - stability calculations (Lh > 12.0 m).
B.4 Structural materials
   - laminate resins
   - fibre reinforcements
   - core materials
   - wood and plywood
   - metallic materials.
B.5 Manufacturing
   - process description
   - quality system information.
B.6 Test reports
   - freeboard measurement
   - intact stability
   - buoyancy, swamped
   - stability, swamped
   - sea trial.
B.7 Reference to Conformity Declarations for CE marked components.

End of Guidance note

140 Definitions

141 ISO 8666, when adopted, will be the basis for the harmonized standard on principal data.

142 The following definitions apply:

\[
L_{\text{max}} = \text{Hull length over all.}
\]

\[
L_h = \text{Hull length in metres. Rubrail and structural parts of the hull construction is included, but excludes outside rudders, outdrives, outboard motors, diving platforms, bowsprits, fittings etc.}
\]

\[
B_{\text{max}} = \text{Overall breadth in metres, rubrail included.}
\]

\[
B_s = \text{Maximum hull breadth in metres, measured to the outside of the hull shell.}
\]

\[
d = \text{Maximum draught in metres, keel included.}
\]

\[
D_s = \text{Depth amidship in metres, measured from sheerline/deck at side to the intersection of the canoe body and the centreline.}
\]

\[
F = \text{Mean freeboard in metres,}
\]

\[
f_r + \frac{f_m + f_s}{3}
\]

where:

\[
f_r = \text{Freeboard measured at extreme forward end.}
\]
The principles for the measurement of $L_h$, $B_{oa}$ and $B_s$ are shown in Figure 2 and for freeboard in Figure 3. Further details on measurements of main dimensions are given in ISO 8666.

143 The following definitions of boat types apply:

Decked boat: Boats with deck that can be closed weather tight from stem to stem uninterrupted by other than a strong superstructure or a cockpit so designed that shipping sea will not fill spaces below deck.

Open boat: Undecked boats.

Sailing dinghy: Sailing boats with light-weight $G$ not exceeding 300 kg.

Keel sailboat: Sailing boats with fixed ballast units and/or ballast keel and with light-weight $G$ exceeding 300 kg.
Motorboat with auxiliary sail: Boat arranged primarily for propulsion by permanently installed engine, and with a smaller sail area relative to the stability of the boat. The sail area shall not be greater than:

$$S_a = \frac{R_m}{128 \cdot a}$$

Weights are specified as follows. The weight is to be adjusted upwards to the nearest 5 kg:

Assumed weight of outboard petrol engine with corresponding tank and battery weight is given in Figure 4.

Assumed weight of equipment is given in Figure 5.

Correction for submerged test weights is given in Figure 6.

**Figure 4** Assumed weight of engines

<table>
<thead>
<tr>
<th>Engine kW</th>
<th>Tank kp</th>
<th>Battery kp</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 3.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3.7 - 6.0</td>
<td>15</td>
<td>-</td>
</tr>
<tr>
<td>6.1 - 26.0</td>
<td>30</td>
<td>-</td>
</tr>
<tr>
<td>26.1 +</td>
<td>30</td>
<td>20</td>
</tr>
</tbody>
</table>

**Figure 5** Assumed weight of equipment

**Figure 6** Correction for submerged test weights

$$G = \text{The lightweight of the boat, i.e. weight of boat structure with outboard engine, installed outfit and equipment.}$$

For boats with sail, the weight of the mast and standing rigging as well as necessary sails and sail equipment to be included.

The maximum load will be stated on the certificate, and will comprise the following weights:
weight of maximum number of persons at 75 kg
- weight of maximum tank content
- weight of equipment in accordance with Fig.3
- weight of additional load which may include:
  - weight of cargo
  - weight of personal effects at 30 kg per person in boats with superstructure.

\[ \Delta = \text{Total weight of boat at maximum load obtained by adding the light weight G and maximum load.} \]

150 Boat design categories

151 Boats in each Category must be designed and constructed to withstand the below parameters in respect of stability, buoyancy, and other relevant essential requirements listed in this chapter, and to have good handling characteristics.

152 For Recreational Craft, only the following service conditions can be approved:

153 **Design category A - Ocean**: Designed for extended voyages where conditions may exceed wind force 8 (Beaufort scale) and significant wave heights of 4 m and above, and vessels largely self-sufficient.
The boat shall be decked and have \( L_h \geq 7,0 \) m

154 **Design category B - Offshore**: Designed for offshore voyages where conditions up to, and including, wind force 8 and significant wave heights up to, and including, 4 m may be experienced.
The boat shall be decked and have \( L_h \geq 5,0 \) m

155 **Design category C - Inshore**: Designed for voyages in coastal waters, large bays, estuaries, lakes and rivers where conditions up to, and including, wind force 6 and significant wave heights up to, and including, 2 m may be experienced.

156 **Design category D - Sheltered Waters**: Designed for voyages on small lakes, rivers and canals where conditions up to, and including, wind force 4 and significant wave heights up to, and including, 0,5 m may be experienced.

160 Hull identification number

161 Each craft shall be marked with a hull identification number including the following information:
- manufacturer’s code
- country of manufacture
- unique series number
- year of production
- model year

The manufacturer is to document that his Hull Identification Number (HIN) is unique for each craft.

162 The relevant harmonized standard gives details of these requirements. Reference is made to ISO 10087 Hull identification coding system for details on Hull Identification Number (HIN). Full compliance with this standard is required.

163 HIN shall have 15 characters including hyphen, and the manufacturer shall keep records on the HIN used in production.

**Guidance note:**

**HIN example:** NO-HXAB7A33G293

where:
- "NO" is the code of the manufacturing country (Norway = "NO")
- "-" is a hyphen
- "HXA" is the identification of the manufacturer (the manufacturer is to document uniqueness of these letters)
- "B7A33" is the serial number of the product in accordance with the records of the manufacturer. The letters I, O and Q must not be used. Each boat shall have its unique HIN and the boat manufacturer is to document the traceability.
- "G" is the month of manufacture in accordance with a code where "G" is written with a capital letter, "A" meaning January and so on till "L" meaning December. "G" is accordingly the letter for the 7th month, July.
- "2" is the last figure of the year of manufacture
- "93" are the last two figures of the year of the model.

End of Guidance note

164 The vessel is to be marked with HIN under construction, or when leaving the place of manufacture at the latest.

165 The HIN marking is to be done in such a way that HIN cannot be changed without leaving distinct marks. HIN may for instance be engraved, branded or moulded. Letters and figures shall have a minimum height of 6 mm.

166 HIN shall be placed on the outside of the hull on the starboard side of the transom, or maximum 300 mm from the aft stem if the vessel does not have a transom. HIN shall not be lower than 50 mm below top of transom, 50 mm below transition between deck/side and be easy to see. HIN is to be at least 50 mm from any other marking on the hull.

167 Somewhere inside the hull, unknown outside the yard, and not easily visible, a HIN duplicate is to be placed. The yard must at any time be able to inform a Notified Body where the HIN duplicate is placed onboard.
The HIN duplicate shall be impossible to remove. In vessels made of composite materials, it may be written/painted, and given a coating of clear gelcoat as protection, before it is covered by fittings, lining etc.

**170 Builder's plate**

171 Each craft shall carry a permanently affixed plate mounted separately from the boat hull identification number, containing the following information:
- manufacturer’s name
- CE marking
- boat design category according to 150
- manufacturer’s maximum recommended load according to 250
- number of persons recommended by the manufacturer for which the boat was designed to carry when under way.

172 Boats with additional class notation CE certified by the Society shall have the builder's plate in accordance with Figure 7.

**Guidance note:**
This standardisation of the builder's plate layout and colour is intended for increased attention to the restrictions on the plate as it is difficult to pay attention to information on signboards of different types.

End of Guidance note

![Figure 7 Builders plate](image)

173 For boats certified by the Society, the builder's plate shall be issued by the Society. By fitting the plate on the boat the manufacturer identifies the individual boat to be of a certified type.

174 For boats in design category D, the Notified Body identification number will not be included on the signboard.

**180 Owner’s manual**

181 Each craft shall be provided with an owner’s manual in the official Community language or languages which may be determined by the Member State in which it is marketed in accordance with the Treaty.

182 This manual should draw particular attention to risks of fire and flooding and shall contain the information listed in 170, 250 and 550 as well as the unladen weight of the craft in kilograms.

183 The Owner’s manual is to be in compliance with ISO 10240 or equivalent and use graphical symbols in compliance with ISO/DIS 11192 or equivalent.

184 One complete set of the owner’s manual is to be submitted for documentation for each type of boat to be certified.

185 Following parts are to be included in the owner’s manual: 170, 250, 470, 550, 560, 720 and 740.

**200 Integrity**

**210 Stability and freeboard**

211 The craft shall have sufficient stability and freeboard considering its design category according to 150 and the manufacturer’s maximum recommended load according to 250. ISO 12217.1, 2 and 3, when adopted, will be the basis for the harmonised standard.

212 Open vessels are to comply with the requirements in the swamped flotation condition if one of the following is applicable:

a) Vessel is less than 6.0 m

b) Vessel has a mean freeboard less than:

\[ F = \frac{4.5 \cdot \Delta}{1000 \cdot Lh \cdot B_{\text{max}}} \] m, minimum 0.5 m.

c) Vessel is an open sailboat.

213 Vessels complying with the requirements in the swamped flotation condition or which are decked, are to have a mean freeboard not less than:

\[ F = \frac{3.2 \cdot \Delta}{1000 \cdot Lh \cdot B_{\text{max}}} \] m, minimum 0.2 m.

214 For open or partially decked vessels the freeboard aft is not to be less than 80% of the required mean freeboard. Open vessels for out-board engine shall have a freeboard aft of at least 100 mm with engine and tank in position and 75 kg placed on the aft thwart.

215 At lightweight condition water is not to flood the vessel at the heeling moment caused by a weight of 20 n kg, but not less than 40 kg, located at gunwale level where the boat has its greatest breadth at a distance of B_{\text{max}}/2 from the vessel’s centreline.

\[ n = \text{the total number of persons for which the boat is to be approved.} \]
The heeling weight at maximum load is to be located at floor height and at a longitudinal position corresponding to the accommodation arrangement onboard. Other weights are to be located at their respective allocated positions on board. The equipment weights are to be located on the floor. Where no special place has been reserved for the equipment, the weights are to be located as far aft as possible.

Significant flooding occurs at the angle at which the total area, A, of down flooding openings into the vessel exceeds:

\[ A = \frac{\Delta (\text{kg})}{1.5 \cdot 10^6 \text{m}^2} \]

Through-hull openings with valves and marked “TO BE KEPT CLOSED AT SEA” may be omitted when calculating A.

Design Category A & B vessels are to have a righting arm at any relevant load condition of at least:

\[ \text{GZ}_{\text{sep}} = 0.20 \text{ m} \]

The greatest value of the GZ curve shall be at an angle greater than 25 degrees. The GZ curve shall be positive up to 60 degrees. The GZ curve shall end at the angle where water enters into the boat.

Decked keel sailboats are in lightweight condition to have a positive righting arm up to a heel angle of at least 130 degrees verified by calculations.

When normal access to cockpit and other accommodation is along scandeck, the heeling angle is not to exceed 15° at a load of 75 kp on scandeck.

Sailing dinghies are to have sufficient stability in lightweight condition, when the centreboard is hoisted, to prevent water entering the boat when a weight of 75 kg is placed at Bmax/4 in way of the mast or where it will be necessary to step when going on board. On decked vessels the weights are placed on deck, in open vessels on the seats or on the floor.

### 220 Buoyancy and flotation

The craft shall be constructed to ensure that it has buoyancy characteristics appropriate to its design category according to 150 and the manufacturer’s maximum recommended load according to 250. ISO 12217.1, 2 and 3, when adopted, will be the basis for the harmonised standard.

All habitable multihull craft shall be so designed as to have sufficient buoyancy to remain afloat in the inverted position.

Boats of less than six metres in length that are susceptible to swamping when used in their design category shall be provided with appropriate means of flotation in the swamped condition.

Appropriate means of buoyancy may consist of air tanks, foam blocks, pre-fabricated or foamed in situ. In situ foaming is subject to special approval in each case to ensure that raw materials, foaming procedure and condition provide sufficient volume and quality of the buoyancy elements.

The buoyancy elements are to be permanently fixed and are to be located and protected in a way that they will not be exposed to mechanical damage.

Separate air tanks or double skin hulls may be accepted as buoyancy elements without being filled with foam, providing the following measures are fulfilled:

- pressure testing of each tank and hull for possible leakage
- air tanks shall not be used as cargo holds
- air tanks can easily be drained
- drain openings can be closed adequately

Pressure test of air tanks is normally to be carried out by an overpressure of 0.008 N/mm², which is not to decrease to less than 0.007 N/mm² within one minute. Large tanks which may be subject to deformations can be tested with a less overpressure for a corresponding longer duration.

### 230 Openings in hull, deck and superstructure

Openings in hull, deck(s) and superstructure shall not impair the structural integrity of the craft or its weathertight integrity when closed.

Windows, portlights, doors and hatchcovers shall withstand the water pressure likely to be encountered in their specific position, as well as pointloads applied by the weight of persons moving on deck. ISO 12216, when adopted, will be the basis for the harmonised standard.

The following requirements apply for boats in design category A and B where weathertight integrity is required for the closing appliances:

Any door or hatch to accommodation or compartment shall open outwards.
Doors are to fulfil rule requirements for strength of the actual bulkhead for which they are fitted.

Doors, hatches and windows that can be opened, are to have minimum two closing devices/dogs in addition to the hinges and are to rest towards their frames. Hatches and windows shall have sufficient sealing.

Sill heights of 300 mm is required for openings from wells on deck. Replaceable sill can be accepted as part of the permanent closing appliance if its strength fulfil the rule requirement for the nearby structure.

Windows are in general to be of toughened safety glass and fitted in fixed frames.

Windows in the freeboard i.e. portlights are not to be located nearer to the deepest waterline than 500 mm and shall be provided with hinged or replaceable deadlights if they are arranged to open.

Windows in the freeboard on sailboats are not to be arranged to open, and shall be provided with deadlights if the size is larger than 200 x 300 mm.

234 The following requirements apply for boats in design category C and D:

Doors and small hatches on deck may be arranged with only one dog. Larger hatches as engine hatches and similar that normally will be kept in place by their weight may be arranged without fastening devices.

Hatches that are fitted horizontally or below the freeboard requirement, are to open outwards.

Doors may open inwards on non-habitable vessels.

Windows are in general to be of toughened safety glass and may be fitted in flexible frames if they are located higher than the minimum freeboard requirement.

Windows in the freeboard, i.e. portlights are not to be located nearer to the deepest waterline than 350 mm and shall be provided with hinged or replaceable deadlights if they are arranged to open. Windows in the freeboard on sailboats are not to be arranged to open, and shall be provided with deadlights if the size is larger than 200 x 300 mm.

235 Windows, portlights and hatches shall have minimum glass thicknesses in accordance with the following table which correspond to toughened safety glass. For polycarbonate is the thickness to be increased by 20%. Other materials may be considered. The thickness shall then be adapted to the strength of the material concerned.

<table>
<thead>
<tr>
<th>WINDOW</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>600</th>
<th>700</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEIGHT</td>
<td>25</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>WIDTH</td>
<td>12</td>
<td>15</td>
<td>18</td>
<td>20</td>
<td>22</td>
<td>25</td>
</tr>
</tbody>
</table>

All dimensions in table are given in mm.

Dimension from column 1 to 3 should be applied as follows:

1) For position above the required freeboard, for design category B and C.
2) For position where weathertightness for the sea is required and for design category A.
3) For horizontal hatches or windows which may be stepped on.

236 Through hull fittings designed to allow water passage into the hull or out of the hull, below the waterline corresponding to the manufacturer’s maximum recommended load according to 250, shall be filled with shutoff means which shall be readily accessible.

237 Valves shall be provided for all through hull openings:

- below 100 mm above loaded waterline
- below waterline on sailboats at 30° heel
- below 350 mm above loaded waterline if inside opening is below this level for design category C & D vessels
- below rule freeboard height if inside opening is below this level for design category A & B vessels.

Valves are not required on self-drain system on boats less than 6,0 metres provided the self-drain does not take in water when the boat is fully loaded or the self-drain system contain a hose that might give waterfilling to the inner structure if damaged

Any through hull valves shall be fitted directly on the hull and be easily accessible without the need of any demountings. Valves and connections are to be of steel, bronze or other ductile material.

Fittings should preferably be in accordance with ISO 9093-1.

238 Hoses connected to valves fitted lower than rule freeboard height for design category A & B vessels and lower than 350 mm above loaded waterline for design category C & D vessels, shall be fitted with twin hose clips of SS in both ends.
239 Exhaust outlets shall be equipped with SS pipe up to a height of 100 mm above loaded waterline if the opening is lower than this level.

Part of the exhaust line shall be arranged in a goose-neck with height of minimum 350 mm above loaded waterline and with fall to the opening.

240 Flooding

241 All craft shall be designed so as to minimize the risk of sinking.

242 Particular attention should be paid where appropriate to:
  - cockpits and wells, which should be self-draining or have other means of keeping water out of the boat interior,
  - ventilation fittings,
  - removal of water by pumps or other means.

ISO 11812, when adopted, will be the basis for the harmonised standard.

243 Sailboats where a heel cannot quickly be reduced by the counterweight of persons onboard, are to be arranged with scandeck to prevent flooding. On open keel sailing boats, the total area of all openings in the deck are not to exceed 30% of the vessel's total deck area. The width of the scandeck is to be considered in each separate case.

244 Self draining of wells on deck shall be provided on any vessel for design category A & B with wells greater than:

\[ V = 0.05 \text{Lh}\ (\text{m}^3) \]

by at least 4 openings of minimum 19 mm inner diameter or at least 2 openings of minimum 25 mm inner diameter. The self draining system shall prove to be effective at any relevant heel angle.

245 Any vessel with \( L_{h} \) above 6,0 metre shall have permanently fixed bilge system by a manual pump from the lowest point of the bilge. Drain to the pump shall be provided from any adjacent compartments below the waterline. Boats with watertight or gas-tight subdivisions shall have bilge capability for each division.

246 Design Category C and D vessels:

Ventilation openings for engine- or tank-compartments and accommodation shall have their openings or part of their ducts at a height above the waterline that fulfill the rule requirement for mean freeboard.

247 Design Category A and B vessels:

Ventilation openings for engine- or tank-compartments and accommodation shall have their openings at a height above the waterline that fulfill the rule requirement for mean freeboard, and shall by their location and design prevent waterfilling by flooding. The height and location shall also prevent waterfilling at a heeling angle of 40° for motor vessels and at 90° for sailing vessels.

250 Maximum recommended load

251 The manufacturer's maximum recommended load (fuel, water, provisions, miscellaneous equipment and people (in kilograms)) for which the boat was designed, as marked on the builder's plate, shall be determined according to the design category given in 150, stability and freeboard in 210 and buoyancy and flotation in 220.

252 Maximum recommended load is to be according to the following:

a) Full load displacement for open vessels are not to be greater than:
\[ \Delta_{\text{max}} = (12 \text{Lh} D_{\text{max}})^{1.5} \text{kg} \]
as given in Figure 8.

b) Full load displacement is not to be greater than what is given by the requirements for freeboard.

c) Full load displacement may be limited by the strength of the vessel in accordance with Pt.3 of the Rules.

253 The maximum number of persons is decided in accordance with the following:

a) The number of persons, each 75 kg, allowed by the freeboard.

b) The number of persons allowed related to the stability of the vessel.

c) The number of seats and accommodation arrangement onboard.

d) The number of persons allowed related to the buoyancy of the vessel, in swamped condition when required.

---

**Figure 8** Full load displacement
Guidance note:
The number of persons in addition to the crew may be limited to 12 to avoid conflict with requirements for passenger vessels.

Vessels with sleeping facilities of more than 12 persons shall have information about passenger restrictions in the Owner's Manual.

End of Guidance note

260 Swamped flotation test

261 A swamped boat is to be understood as a boat that cannot be filled with more water without this draining out over the lowest point on the gunwale, transom or other openings.

262 Any part of the accommodation or installations removed during the swamped flotation test shall be replaced by equivalent weights. Boats for outboard engines shall be tested with weights equivalent to the following figure.

Weight of 20 kg for each dedicated place for battery shall be provided.

No weight for transportable fuel tank shall be provided for the test. Fixed fuel tank shall be filled or be removed.

Weight corresponding to an empty fixed tank shall be applied if the tank is removed.

Weight for equipment in swamped condition shall be taken as:

\[ P = 75 \text{ kg} \]

\[ P = 25 \text{ kg for each of the persons for which the boat is to be approved.} \]

\[ P = 50 + 50 (Lh - 2.5) + C \text{ kg} \]

where

\[ C = \text{additional weight equal to 33 percent of any weight of cargo the boat is intended to carry.} \]

\[ P = 75 \text{ kg} \]

\[ P = 50 + 40 (Lb - 2.5) + C \text{ kg} \]

The weights are to be positioned according to the arrangement onboard.

266 Weights used in swamped condition tests shall, if reduced more than 15 percent when submerged i.e. equal to weight of iron, be adjusted accordingly.

270 Swamped stability test

271 A swamped boat, fully equipped and with weights for the engine, permanent fittings and equipment in accordance with 260, is not to capsize when loaded with a heeling weight corresponding to the largest of the following:

\[ P = 25 \text{ kg} \]

\[ P = 10 + 5 n \text{ kg} \]

where:

\[ n = \text{the total number of persons for which the boat is to be approved.} \]

Any tank i.e. fuel, water or void which may have negative effect on the stability of the swamped boat shall be empty and sealed off during the swamped stability test.
272 The heeling weight is to be located with its centre of gravity at the level of the gunwale. The boat is to comply with the stability requirement independent of the longitudinal position of the heeling weight on the gunwale.

273 The swamped boat shall have positive stability up to a 60° heel with weight of engine and equipment located on their respective places on board.

274 Sailing boats shall in lightweight condition, rigged, but without sail, when heeled until top of mast hits the water, be able to float satisfactorily and not heel any further. Sailing dinghies are to be tested with the centerboard in the upper position.

300 Structural requirements

310 Structure

311 The choice and combination of materials and its construction shall ensure that the craft is strong enough in all respects.

312 Special attention shall be paid to the design category given in 150, and the manufacturer's maximum recommended load in accordance with 250.

313 The craft is to be constructed in accordance with the requirements in Pt.3.

400 Machinery and power supply

410 Inboard engine

411 All inboard mounted engines shall be placed within an enclosure separated from living quarters and installed so as to minimize the risk of fires or spread of fires as well as hazards from toxic fumes, heat, noise or vibrations in the living quarters.

412 The engine compartment shall be arranged in such a way that it cannot be used for other purposes. Stowing compartments shall be separated from the engine compartment by bulkheads or similar.

413 The main propulsion units shall be designed for marine use and environments onboard vessels exposed to extensive roll, heave and pitch movements in a seaway condition.

414 Boats with inboard petrol installation are to be arranged with gas-tight sub-division for engine and tank compartments to prevent explosive gas from spreading throughout the boat. Gas-tight sub-division shall be maintained at least up to the adjacent accommodation structures, such as seats, benches, floors, etc. which lead to open air in accordance with the principles shown in Figure 9 and Figure 10.

Penetrations in gas-tight sub-divisions shall be sealed tight to such an extent that no openings exist.

Figure 9 Gas-tight subdivision, example 1

Figure 10 Gas-tight subdivision, example 2

415 In case of petrol installations, batteries shall not be arranged within the gas-tight subdivisions for motor or fuel tank. Battery may be placed in a separate part of the engine or tank-compartment provided this part is gas tight in bottom and sides up to a level corresponding with the principle shown in the figure.

416 The exhaust piping is to be arranged and mounted in such a way that leakage and mechanical wear are prevented. The piping is, however, not to be covered by moulded composites.

Rubber exhaust hoses shall be water cooled and are to have an indicator of alarm for loss of seawater cooling and high temperature in the hose.

Minimum 2 clips of stainless steel at each coupling is required for fitting of the hose.

Steel exhaust pipes with a surface temperature above 80° C, are to be insulated or equipped with protection against injuries from exposed parts and also be arranged in such a way that materials close to the piping will not reach temperature higher than 65° C.

417 Rubber exhaust hoses are to be made by an inner and outer rubber layer covering a reinforcement. Rubber exhaust hoses are to be Type Approved.

Exhaust pipes of steel tubes/plates are not to have a thickness less than 3 mm.

418 Engine parts and accessories that require frequent inspections and/or servicing shall be readily accessible.

419 The insulating materials inside engine spaces shall be non-combustible.
Insulation material shall have an oxygen index of at least 21. The surface shall be covered with an oil-tight layer.

420 Ventilation

421 The engine compartment shall be ventilated. ISO 11105, when adopted, will be the basis for the harmonised standard.

422 For petrol installations the ventilation arrangement of the engine compartment and fuel tank compartment is to have separate ducts for air intake and extraction to the outside of the boat. Intake and outlet are normally to be located at opposite ends of the compartment with the duct for extraction led to the lower part of the compartment.

423 Ducts for ventilation shall have a cross section of at least:
\[ A = 40 \, V \, \text{cm}^2, \text{not less than} \, 45 \, \text{cm}^2 \]
where \( V \) is net volume in \( \text{m}^3 \) of ventilated compartment.

424 Compartments for inboard petrol engines shall in addition to natural ventilation also have mechanical ventilation leading from the lower part of the compartment to the outside of the boat. The ventilation fan is to be documented with respect to capacity and ignition protection. A signboard is to be fitted at the steering position, stating that the ventilation fan is to be run for at least 2 minutes prior to starting of a petrol engine.

425 The fan for mechanical ventilation shall have a minimum capacity of:
\[ Q = 1,0 \, V \, \text{m}^3/\text{min}, \text{not less than} \, 1,5 \, \text{m}^3/\text{min} \]
where \( V \) is the net volume in \( \text{m}^3 \) of the petrol engine compartment.

426 The dangerous ingress of water into the engine compartment through all inlets must be prevented. ISO 12217, when adopted, will be the basis for the harmonised standard.

427 The freeboard height may be measured to the height of the inside opening of the ventilation duct.

430 Exposed parts

431 Unless the engine is protected by a cover or its own enclosure, exposed moving or hot parts of the engine that could cause personal injury shall be effectively shielded.

432 Engine compartments which might be entered while the engine is in operation, is to be arranged with adequate shielding of the engine, non-skid surface on the floors and handholds to avoid personal injuries.

440 Outboard engines arrangement

441 All boats with outboard engines shall have a device to prevent starting the engine in gear, except:

(a) when the engine produces less than 500 Newton’s (N) of static thrust;

(b) when the engine has a throttle limiting device to limit thrust to 500 N at the time of starting the engine.

442 Only CE marked outboard engines in compliance with ISO 11547 is to be specified for use on the boat. This shall be stated in the Owner’s Manual.

443 Boats intended for engine larger than 15 kW are to be arranged in a way that fitting of the engine to the transom is possible by use of bolts through the transom.

444 The transom is to be fitted with a protection plate on each side. The plates are to be fitted firmly and the top of the inner plate is to have a ridge of minimum 5 mm depth. The inner plate may be omitted on boats solely intended for bolt-on engines.

445 Boats intended for engine larger than 15 kW are to have an engine well large enough to enable tilting of the largest engine that the boat is intended for, and is to have a drainage of minimum diameter 15 mm to the sea.

450 Fuel system, general

451 The filling, storage, venting and fuel-supply arrangements and installations shall be designed and installed so as to minimize the risk of fire and explosion. ISO 7840, ISO 8469 and ISO 10088, when adopted, will be the basis for the relevant harmonised standard. Fuel hoses are to be CE-marked if intended for application in boats with class notation CE.

452 Fuel tanks and fuel lines are not to be located adjacent to any hot surface, engine or exhaust line.

453 Each tank shall normally have separate fuel filling and ventilation line. Filling and tank ventilation openings shall be located outside the boat to prevent spill and overflowing to enter the boat. The inner diameters are at least to be \( \Phi=38 \, \text{mm} \) for fuel filling and \( \Phi=12 \, \text{mm} \) for tank ventilation. The tank ventilation opening shall be located in such a way that water cannot enter into the tank.

Adequate standard of the fuel hoses shall be documented. Fuel filling and tank ventilation openings are to be located at least 0,4 metre measured in the horizontal plane from any ventilation openings.

440 Outboard engines arrangement

A water-separation filter is to be fitted in the engine compartment.
454 Boats with inboard petrol installations shall have permanent tank arrangement with all connections to the top of the tank.

Fuel line from the tank is to be of copper.

Flexible hoses may be used between the water-separation filter and the engine. The fuel hose is to be as short as possible and fitted with connections of screw type.

455 Boats with inboard diesel installations may have fuel tanks with openings in the bottom and sides. Connections between tanks may be accepted if shut-off valves are fitted at the tank connections.

Fuel lines between the tank and engine may consist of fuel hoses and fitted with minimum 2 hose clips of stainless steel at each connection.

456 Readily accessible shut-off valve for the fuel line shall be arranged as close to the tank as possible.

457 In a fuel system for petrol all metallic components, from the filling spigot on deck to and including the engine, shall be connected by an electric conductor of minimum 1.5 mm².

458 In boats approved for outboard engines of 4 kW or more, a suitable position with fastening devices for portable tanks is to be arranged. The space for the tank is to be arranged in a way that it is easy to position the tank without spill.

460 Fuel tanks

461 Fuel tanks, lines and hoses shall be secured and separated or protected from any source of significant heat ISO 10088, when adopted, will be the basis for the relevant harmonised standard.

Fuel tank purchased from sub-supplier and fuel hoses are to be CE marked if intended for application in boat with class notation CE.

462 The fuel tank with components are to have sufficient strength and fitted in a way that the system will withstand the accelerations and vibrations to which it may be exposed without any leakage occurring.

463 The material the tanks are made of and their method of construction shall be according to their capacity and the type of fuel.

464 All materials used in the fuel installation i.e. tanks, hoses, are to be resistant to the substances with which they will normally come into contact. The resistance of the material is to be documented.

Tanks of volume larger than 50 litres are to have wash-bulkheads and an inspection hatch.

Spigots for hose connections are to have grooves and length sufficient for fitting of at least 2 hose clips.

465 All tank spaces shall be ventilated.

466 Compartments for fixed petrol tanks are to be ventilated in accordance with 422 and 423. Diesel tank space may be ventilated through duct to the engine compartment.

467 Compartments for portable petrol tanks shall be ventilated to the open part of the boat through an opening of a total of at least 20 cm² over the full length of one side or through 2 openings of at least 10 cm² each located at each end of the compartment. The openings are to be located as close to the bottom of the tank compartment as practical. Otherwise are ventilation ducts from bottom of the tank compartment to be arranged.

468 Liquid fuel with a flash point below 55°C shall be kept in tanks which do not form part of the hull and are:

(a) insulated from the engine compartment and from all other source of ignition;

(b) separated from living quarters.

Reference is made to 414 regarding gas-tight subdivision

469 Liquid fuel with a flash point equal to or above 55°C may be kept in tanks that are integral with the hull.

470 Electrical system

471 Electrical systems shall be designed and installed so as to ensure proper operation of the craft under normal conditions of use and shall be such as to minimize risk of fire and electric shock.

Attention shall be paid to the provision of overload and short-circuit protection of all circuits, except engine starting circuits, supplied from batteries.

ISO 8849, ISO 9097, ISO 10133 and ISO 13297 are referred to as basis for the harmonised standards.

472 Ventilation shall be provided to prevent the accumulation of gases which might be emitted from batteries. Batteries shall be firmly secured and protected from ingress of water.

473 The following rules apply to electrical installation for DC current with a rated voltage of up to 48 V. The installation can consist of either two separately insulated conductors or two conductors where one is connected directly to the power source. The hull is not to be used as conductor.

Higher voltage installation is to be documented in compliance with national requirements to marine electrical installation.

The following rules do not apply to electrical components on engines or other electrical equipment as radio receivers, electrical motors, horns, instruments, lights, etc. However, if it is found that electrical components that are used might effect the safety of the vessel, requirements can be made.
Rules for Boats, December 1997
Pt.4 Ch.1
Page 16

Wiring diagram is to be supplied with the owner's manual for the boat.

474 A suitable location for the battery installation is to be provided in boats which have permanent electrical installation and in boats certified for outboard engines with power ratio higher than 26 kW (35 hp).
Batteries are to be so located that they will be easily accessible, adequately secured and in boats which might experience severe heeling, fitted in boxes of acid resistant material.
Batteries are not to be located in the same compartment as petrol engine and petrol fuel tank.
Batteries placed in a separate part of the tank- or engine-compartments according to 415 and battery installations of more than 5 kWh are to be located in compartments with ventilation to open air.

475 An easily accessible main switch is to be located as close to the battery as possible and is to cover all circuits. Gas or burglar alarms, heating or radio equipment and automatic bilge pumps may be connected directly to the battery by way of separate fuses.
Switches and fuses other than those necessary for the operation and inspection of the engine, are not to be located in engine or tank compartment for petrol installations or in enclosed battery compartment.
The cables to the starter motor on an engine is to be of single conductors. One of the conductors is to be fitted to the main switch.
Supply from the battery installation to other consumers than those on the main propulsion engine and generator, is to be led to one or more centrally located distribution and fuse panels.
Cables from main switch to fuse panel is to have a cross section area of at least 4 mm². The cable is either to have fuses at the main switch or to be laid as single conductors.

476 The following requirements apply for cables:
to be of multi-strand conductors
- insulated by self-extinguishing material
- marked for identification on wiring diagram
- able to be replaced
- not to be embedded in to laminate
- securely clamped or run in tubes which are to be properly fastened and drainable for water or condensate
- protected against heat and mechanical damage.
Cables from fuse panels to consumers are to have a minimum cross section area and maximum fuse protection according to table:

<table>
<thead>
<tr>
<th>Area (mm²)</th>
<th>Fuse (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>6</td>
</tr>
<tr>
<td>1.5</td>
<td>10</td>
</tr>
<tr>
<td>2.5</td>
<td>16</td>
</tr>
<tr>
<td>4.0</td>
<td>20</td>
</tr>
<tr>
<td>6.0</td>
<td>25</td>
</tr>
<tr>
<td>10.0</td>
<td>32</td>
</tr>
<tr>
<td>16.0</td>
<td>50</td>
</tr>
<tr>
<td>25.0</td>
<td>63</td>
</tr>
<tr>
<td>35.0</td>
<td>80</td>
</tr>
<tr>
<td>50.0</td>
<td>100</td>
</tr>
</tbody>
</table>

Fuses are to be of type neozed or diazed
Automatic fuses are to be of a type that have to be manually re-set and are to be capable of breaking short circuit current of at least 100 A.

478 Electrical equipment are to have a degree of protection that at least meets the requirements in IEC publication 529 according to the following table:

<table>
<thead>
<tr>
<th>Location on board</th>
<th>Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>protected accommodation</td>
<td>IP 20</td>
</tr>
<tr>
<td>sheltered by a roof</td>
<td>IP 22</td>
</tr>
<tr>
<td>exposed to spray</td>
<td>IP 44</td>
</tr>
<tr>
<td>exposed to shipping of water</td>
<td>IP 56</td>
</tr>
</tbody>
</table>

500 Steering and manoeuvring

510 Visibility

511 For motor boats, the main steering position shall give the operator, under normal conditions of use (speed and load), good all-round visibility.
ISO 11591, when adopted, will be the basis for the harmonised standard.

512 The view from the helmsman position shall in either sitting or standing position allow:
- to see the water within 4 Lh ahead and to the sides
- to see the horizon ait of the craft at an angle great enough to check the course
- for navigation with sails set
- for navigation without having to remove curtains or canvas.

513 Wipers shall be arranged on windows located in front of the helmsman position, unless it is natural to see over the top of the window during poor visibility.

514 The helmsman position shall be arranged in a way that the navigation and manoeuvring are neither hampered by lights nor reflexes, even in bright sunlight or in the dark.
515 The windows in front and the sides of the helmsman’s position shall not be tinted or have qualities which reduces or changes the lights from outside during night navigation.

520 Steering system

521 Steer systems shall be designed, constructed and installed in order to allow the transmission of steering loads under foreseeable operating conditions.

522 Boats approved for outboard motors rated higher than 15 kW (20 hp) shall be fitted with a permanent wheel steering arrangement. Permanent steering arrangement may be required for lower ratings when found necessary.

523 Steering consoles and all components in the steering arrangement shall be built, stiffened and fixed in a way that the forces acting on the system, including the dynamic loads transferred from the helmsman, will be absorbed.

Steering systems are to be documented with certificates.

524 The steering arrangement shall ensure steady and reliable manoeuvring of the boat at the maximum engine power for which the boat is to be certified.

Boats with a maximum speed higher than 25 knots, shall have the steering wheel positioned in a suitable distance in front of the helmsman’s position. Remote control for gear/throttle shall be located within an arm length distance, and be readily operable without the helmsman moving more than one arm from the wheel.

Boats with a maximum speed higher than 40 knots, is to have other controls such as tilt, trim of engine and trimflaps, readily operable without the helmsman moving more than one hand from the wheel. Important instruments as revolution counter, trim indicator, compass etc. shall be located within eyesight in front of the helmsman.

525 Boats with a maximum speed higher than 15 knots and with an open, unprotected helmsman position, shall have a label stating the following:

“EMERGENCY STOP SWITCH TO BE USED”

530 Emergency steering arrangements

531 Sailboat and single-engined inboard powered motor boats with remote-controlled rudder steering systems shall be provided with emergency means of steering the craft at reduced speed.

532 The emergency means of steering may consist of a removable tiller arm which is readily accessible and easily fitted to the rudder post without use of any tool.

540 Navigation lights

541 Where navigation lights are fitted, they shall comply with the 1972 CoReg, or CEVNI regulations, as appropriate.
600 Fire safety

610 Fire protection in general

611 The type of equipment installed and the layout of the craft shall take account of the risk and spread of fire. ISO 9094.1 and 2, when adopted, will be the basis for the harmonised standard.

612 Special attention shall be paid to the surroundings of open flame devices, hot areas or engines and auxiliary machines, oil and fuel overflows, uncovered oil and fuel pipes and avoiding electrical wiring above hot areas of machines.

613 Materials within a distance from an open flame as shown in Figure 11 shall comply with the following requirements, taking into account the movement of a gimbaled stove:
- curtains or other fabrics shall not be fitted within the area
- materials within range I shall be non-combustible or with similar fireproof characteristics
- materials within range II shall be non-combustible or with similar fireproof characteristics if the surface temperature exceeds 80 °C.

614 Openings for dry exhaust from engines, heaters, cooking stoves etc. shall be located at least 1 metre in the horizontal plane from fuel fillings and tank ventilation openings and in addition as well from engine- and tank-compartment ventilation openings when petrol installations.

615 Fuel tanks for heaters, stoves larger than 5 litres shall be installed and ventilated in accordance with 460.

620 Fire-fighting equipment

621 Craft shall be supplied with fire-fighting equipment appropriate to the fire hazard.

622 Petrol engine enclosures shall be protected by a fire extinguishing system that avoids the need to open the enclosure in the event of fire.

623 Boats with inboard petrol engine shall be equipped with a permanently installed extinguishing system to engine compartment.

For CO₂ the amount of extinguishing medium shall not be less than 0,8 kg/m³ net volume of each compartment, and fitted with an automatic shut-off device for mechanical ventilation.

The extinguishing system is to be released manually. Systems other than CO₂ may be fitted with optional automatic release at 75°C.

624 The fire extinguishing system shall be type approved and shall contain at least 2 kg extinguishing medium.

625 Where fitted, portable fire extinguishers shall be readily accessible and one shall be so positioned that it can easily be reached from the main steering position of the craft.

626 Boats with an inboard engine or boats with outboard engine with power ratio higher than 26 kW (35 hp), or boats with cooking stove or permanently installed heater or other permanently installed combustion apparatus, are to be equipped with a number of approved hand held fire extinguishers of fire class AB or ABE with at least efficiency class II containing at least 2 kg of extinguishing medium according to table.

<table>
<thead>
<tr>
<th>Boat Lh equal to or larger than:</th>
<th>Number of</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,5 m</td>
<td>1</td>
</tr>
<tr>
<td>10,0 m</td>
<td>2</td>
</tr>
<tr>
<td>15,0 m</td>
<td>2</td>
</tr>
<tr>
<td>20,0 m</td>
<td>1</td>
</tr>
</tbody>
</table>

630 Gas system

631 Gas systems for domestic use shall be of the vapour-withdrawal type and shall be designed and installed so as to avoid leaks and the risk of explosion and be capable of being tested for leaks.

632 Materials and components shall be suitable for the specific gas used to withstand the stresses and exposures found in the marine environment.

633 Each appliance shall be equipped with a flame failure device effective on all burners.

634 Each gas-consuming appliance must be supplied by a separate branch of the distribution system, and each appliance must be controlled by a separate closing device.

635 Adequate ventilation must be provided to prevent hazards from leaks and products of combustion.

636 All craft with a permanently installed gas system shall be fitted with an enclosure to contain all gas cylinders. The enclosure shall be separated from the living quarters.
Personal safety

Protection from falling overboard and means of reboarding

Depending on the design category, craft shall be designed to minimize the risks of falling overboard and to facilitate reboarding.

The boat is to be provided with safe seats for the number of persons for which it is to be approved. The term safe seats refers to a seat of at least 0.5 m width, sufficient room above the head of minimum 0.9 m free height measured from the rear edge of the seat and approximately 0.75 m free length for legs measured from the back support. Seats which are not permanently fixed are not to be regarded as safe seats on boats with maximum speed above 20 knots.

For decked keel sailing boats the number of persons will be limited to the number of seats available in the cockpit plus one person per 0.5 m² total floor area in cockpit. However, this number need not be less than 50% of the requirement stipulated above.

Aft seats in boats with outboard engines are to be located away from the outboard engine or equipped with protection to prevent persons from being hurt in case of engine bouncing up due to grounding or reversing.

Boats with a speed above 15 knots shall have a protective coaming of at least 150 mm height around the seats against side and transom. Boats with a speed less than 15 knots shall have a protection coaming of at least 100 mm height.

All boats shall be provided with such facilities that the people onboard can keep a firm hold to protect themselves from being injured or falling overboard. Deck and gunwales of a size and design that makes it reasonable to assume that persons will walk on, are to be equipped with railings, hand holds on roof top or other satisfactory means to hold on to.

Sailing boats are to have guard rails / wires along the deck. The height of guard rails is to be in accordance with the following table with respect to design category:

<table>
<thead>
<tr>
<th>Category</th>
<th>Lh &gt; 15 m:</th>
<th>Lh &lt; 15 m:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A and B</td>
<td>750 mm</td>
<td>600 mm</td>
</tr>
<tr>
<td>C</td>
<td>600 mm</td>
<td>500 mm</td>
</tr>
</tbody>
</table>

Decks and gunwales on which persons are expected to walk, are to be provided with a sufficient non-skid surface such as moulded in grooves or non-skid coating. On gunwales a 25 mm high toe rail is accepted as an alternative. Open boats with Lh less than 6.0 metres is to have the floor provided with non-skid surface.

Boats with Lh equal to or larger than 6.0 metres and boats with freeboard amidships, f, of at least 50 cm at light weight, are to be arranged with a permanent rescue ladder. The lower step is to be arranged at least 300 mm under the waterline when in use. Alternatively any other suitable arrangements be accepted if found to be functionally equal to a permanent ladder. Convertible ladders are not regarded as permanent rescue ladders.

For which buoyancy materials are required shall be arranged to enable persons to have a firm hold to the boat in a capsized condition. If the boat does not have a keel with a height of at least 60 mm, which is possible to reach from lying in the water beside the capsized boat, it is to be fitted with two fixed hand holds, one on each side of transom stern as close to the waterline as possible. Alternatively at least two hand holds on each side, located in a way that they are visible on, the capsized boat, is to be arranged. If lifeline is fitted, it is to be arranged on the outside of the boat-hull and is to be of a floating material.

Liferaft stowage

All craft of categories A and B, and craft of categories C and D longer than six metres shall be provided with one or more stowage points for a liferaft (liferafts) large enough to hold the number of persons the boat was designed to carry as recommended by the manufacturer.

This (these) stowage point(s) shall be readily accessible at all times.

Escape

All habitable multihull craft over 12 metres long shall be provided with viable means of escape in the event of inversion.

All habitable craft shall be provided with viable means of escape in the event of fire.

Boats with enclosed superstructure with more than 4 seats and boats with long, open superstructure, shall have at least two exits, one may be an emergency exit. Small spaces may be accepted with one exit, provided that this space will not be effected by fire in engine room or pantry. The exit shall not open towards the route of escape.

Emergency exit shall be located in opposite ends of the space and shall be easy to use in an emergency situation. Ladders, handholds, etc. may be required to make the exit available. The minimum size is to be 450 x 450 mm or minimum \( \Phi = 500 \) mm.

Anchoring, mooring and towing

All craft, taking into account their design category and their characteristics shall be fitted with one or more strong
points or other means capable of safely accepting anchoring, mooring and towing loads.

742 Adequate mooring equipment i.e. number of ropes, diameter and length, anchor weight etc. shall be specified in the Owner's Manual. Such equipment is not regarded as a permanent part of the boat.

743 All boats are at least to have a number and location of mooring cleats according to the following:

<table>
<thead>
<tr>
<th>Lh</th>
<th>Cleats Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4</td>
<td>one cleat fore and one aft</td>
</tr>
<tr>
<td>&lt; 6</td>
<td>one cleat fore and two aft</td>
</tr>
<tr>
<td>&lt; 12</td>
<td>two cleat fore and two aft</td>
</tr>
<tr>
<td>&lt; 24</td>
<td>two cleat fore, one each side midship and two aft</td>
</tr>
</tbody>
</table>

744 One cleat fore and one aft is to be fitted in a way that they can serve as towing cleats.

Boats less than 6.0 m and without deck can have a towing cleat at the stern which also will be regarded as forward mooring cleat if easily reached from onboard the boat.

745 The mooring cleat is to be of a size that will accept minimum four turns of following rope diameter depending on boat size.

<table>
<thead>
<tr>
<th>Up to displacement (kg)</th>
<th>Rope diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>8</td>
</tr>
<tr>
<td>2 000</td>
<td>10</td>
</tr>
<tr>
<td>3 500</td>
<td>12</td>
</tr>
<tr>
<td>6 000</td>
<td>14</td>
</tr>
<tr>
<td>8 000</td>
<td>16</td>
</tr>
<tr>
<td>10 000</td>
<td>18</td>
</tr>
<tr>
<td>12 000</td>
<td>20</td>
</tr>
<tr>
<td>20 000</td>
<td>24</td>
</tr>
<tr>
<td>35 000</td>
<td>34</td>
</tr>
<tr>
<td>50 000</td>
<td>40</td>
</tr>
</tbody>
</table>

800 Discharge prevention

810 Accidental spill

811 Craft shall be constructed so as to prevent the accidental discharge of pollutants (oil, fuel, etc.) overboard.

812 The fuel filling spigot is to be fitted so as to enable to see if the level of fuel is topping up in the fuel filling line while filling before overflow through the fuel ventilation openings occurs.

813 Access is to be provided to enable to clean the engine compartment bilge under the engines. Otherwise spill tray is to be arranged.

814 Spaces arranged for small fuel tanks less than 5 litres serving cooking stoves, heaters etc., is to have a liquid tight bottom to prevent drainage to the bilge system. It shall be stated in the Owner's manual that these spaces are arranged as such.

820 Toilets

821 Craft fitted with toilets shall have either:

(a) holding tanks; or

(b) provision to fit holding tanks on a temporary basis in areas of use where the discharge of human waste is restricted.

822 Boats for use in restricted areas for discharge of human waste is to have a through the deck fitting from the holding tank to enable deposit directly to a waste station.

830 Sealed shut arrangement

831 In addition, any through-the-hull pipes for human waste shall be fitted with valves which are capable of being sealed shut.

900 Components

910 Ignition-protected equipment for inboard and stern drive engines

911 Documentation on the ignition protected equipment shall be available if found necessary from a safety point of view. Reference is made to ISO 8846.

920 Start-in-gear protection devices for outboard engines

921 The Owner's Manual for boats with outboard engine above a certain size shall specify that only engines with start in gear protection shall be used. Reference is made to ISO 11547.

930 Steering wheels, steering mechanisms and cable assemblies

931 Documentation is to be provided for the steering gear used on board. Reference is made to ISO 8847, ISO 8848, ISO 9775, ISO 10592.

940 Fuel tanks and fuel hoses

941 Documentation is to be provided for the fuel tanks and fuel hoses used on board. Reference is made to ISO 7840, ISO 8469 and ISO 10088.

950 Prefabricated hatches and portlights

951 Documentation is to be provided for hatches and portlights used on board. Reference is made to ISO 12216.

960 CE marking

961 If the above components are purchased from sub-suppliers, they shall be CE marked if they are intended to be applied in boats with class notation CE.

DET NORSKE VERITAS
PART 7 CHAPTER 1

APPROVAL OF RAW MATERIALS

DECEMBER 1997

CONTENTS

100 Type approval and certification procedures ........ 3
110 Application ..................................................... 3
120 Approval procedure ........................................... 3
130 Approval testing .............................................. 3
140 Random inspection ............................................ 3
150 Product marking ................................................ 5
200 Glass fibre reinforcements .................................. 3
210 Chemical composition ........................................ 3
220 Properties ......................................................... 4
300 Polyester products ........................................... 4
310 Resin properties ................................................. 4
320 Gelcoat and topcoat properties ............................. 4
400 Sandwich core materials .................................. 4
410 General requirements ........................................ 4
420 Properties ........................................................ 4
500 Sandwich adhesives and cement ......................... 5
510 Properties ........................................................ 5
600 Polyethylene and ABS ...................................... 5
610 General ............................................................. 5
620 Properties and documentation ............................. 5
630 Properties of polyethylene ................................. 5
640 Properties of ABS ............................................. 5
700 Buoyancy materials .......................................... 6
710 Buoyancy materials for lifeboats ......................... 6
720 Water absorption .............................................. 6
730 Oil resistance .................................................... 7

DET NORSKE VERITAS
Veritasveien 1, N-1322 Hovik, Norway Tel.: +47 67 57 99 00 Fax: +47 67 57 99 11
FOREWORD

Det Norske Veritas is a free-standing, autonomous and independent Foundation with the object of safeguarding life, property and the environment at sea and ashore.

Det Norske Veritas AS, a fully owned subsidiary Society of the Foundation, undertakes classification and certification and secures the quality of ships, mobile offshore units and fixed offshore installations, facilities and systems, and carries out research in connection with these functions. Moreover, the Society, provided its integrity is not impaired, may perform assignments which utilize its knowledge or which contribute to develop knowledge that will be required for the performance of these assignments.

The Foundation was established in 1978 as a direct continuation of the association The Norske Veritas which was established in 1864.

This new rule booklet was approved by the Board in August 1997.

Text quoted from IMO Resolution A.689(17) is printed in italics, while normal types are applied for additional necessary texts.

© Det Norske Veritas AS 1997

Data processed and typeset by Division Technology and Products, Det Norske Veritas AS

Printed in Norway by Det Norske Veritas AS
100 Type approval and certification procedures

110 Application

111 The rules in this section apply to raw materials for thermoplastic and GRP structures intended for certification with the Society.

112 Other materials may be accepted based upon testing and approval in each individual case.

120 Approval procedure

121 Approval of production and products with respect to the materials and grades covered by this section will be considered on the basis of a detailed description of the manufacturing process and inspection routines, results from an approval testing of material from the current production, and a report made by the surveyor confirming the information given by the manufacturer and the results.

The Type Approval procedure is described in DNV Certification Note 1.2, while the requirements for approval of each material is specified in the respective Type Approval Programme.

122 The following products are to be approved:
- glass fibre reinforcements
- polyester products
- sandwich core materials
- sandwich adhesives and cement
- thermoplastic granulate/powder and sheets.

123 The surveyor is to be given the opportunity to inspect and check at any time all equipment used in the manufacture and testing of materials. The manufacturer is to assist the surveyor to enable him to verify that approved processes are adhered to and to witness the selection and testing as required.

124 When a manufacturer has more than one works, the approval is only valid for the works which carried out the test program.

125 Any approval may be withdrawn if the conditions presupposed when the approval was given, no longer are fulfilled.

126 A type approval for each material grade is granted for a period of 4 years and will be published in the Society’s list of type approved products. At the end of the approval period the manufacturer may apply for renewal of the approval, which will normally be assessed on the basis of random sample testing.

127 A data sheet or specification including at least those data for which requirements are given in 200, 300, 400 and 500 is to be submitted. If considered necessary, additional information for a particular type of material or material grade may be required.

128 A quality control manual for the production is to be submitted for consideration. This manual shall cover all steps in the production and include details on:
- control of raw materials
- test equipment, test methods, test samples and references to standards use
- system for identification.

130 Approval testing

131 An approval testing to verify the compliance with the requirements specified for the material in question is to be carried out.

132 Other standardised test methods than those given for the respective materials may be used upon agreement.

140 Random inspection

141 Random inspection will be carried out to an extent decided when the approval is granted.

142 Production control records are at any time to be presented upon request from the surveyor.

150 Product marking

151 The manufacturer has to carry out delivery testing on each lot. The requirements marked * are to be fulfilled by the delivery testing. The testing results are to be recorded and are to be available for the surveyor during inspections.

152 Each delivery is to be marked with the name of the manufacturer and type designation in accordance with the type approval certificate. The delivery testing specified in 151 may be substituted by production control testing specified in an approved quality control system.

200 Glass fibre reinforcements

210 Chemical composition

211 The glass is to be of E-quality where the sum of Na_2O and K_2O is to be less than 1%. A certificate showing chemical composition is to be presented, or a chemical analysis is to be carried out showing that the requirements to E glass have been met (SiO_2 52-56 %, CaO 16-25 %, Al_2O_3 12-16 %, B_2O_3 6-12 %, Na_2O + K_2O 0-1 % and MgO 0-6 %).

212 Fibres made of other glass qualities may be used subject to special agreement and provided that their mechanical properties and hydrolytic resistance are equally good or better.

213 Coupling agents of silane compound or complex chromium compound are to be used.
220 Properties

221 The glass fibres are to be produced as continuous fibres. They are tested in that product form which is to be used.

222 For roving which will be applied by spraying, a demonstration is to be made in the surveyor’s presence which is to show that the roving is suitable for this form of application.

223 Requirements for glass fibre products are given in Table 200.1

300 Polyester products

310 Resin properties

311 The approval of polyester is divided into 2 different quality grades:
Grade 1: Quality with good water resistance.
Grade 2: Quality with normal water resistance.

Both grades can be approved as fire retardant qualities provided compliance with the following:

The hull and canopy material should be flame tested to determine its fire-retarding characteristics by placing a test specimen in a flame. After removal from the flame the burning time and burning distance should be measured and should be to the satisfaction of the Administration.

(IMO Res. A.689(17) Pt. I 6.2.1)

312 The polyester is to be suitable for lamination by hand lay-up or spraying. It is to have good wetting properties and is to cure satisfactorily at normal room temperature.
Polyester intended for other production methods are to be approved after special consideration.

313 Requirements for resin in liquid condition are given in Table 300.1.

314 Requirements for cured resin are given in Table 300.2.
Comments: Unless anything else is specified by the manufacturer, the following curing procedure should be used:

- 1 % MEKP in a 50 % solution.
- curing: 24 hours at 20°C
- post-curing: 24 hours at 50°C.

315 Polysteres containing waxes or other substances that might lower the secondary bonding ability is in addition to be subjected to the following delamination tests:
Preparation of sample:

- a primary laminate consisting of 3 layers of 450 g/m² emulsion mat and resin rich surface is cured at 20°C for 48 hours
- a secondary laminate also consisting of 3 layers of 450 g/m² mat is built on top of the primary without any treatment of the laminate surface.

Curing minimum 1 week at 20°C.

Tension test:

- Tension test in flatwise plane according to ASTM C297. The fracture stress shall be minimum 9 N/mm². The fracture is not to be evidencing brittle fracture with even surfaces.

320 Gelcoat and topcoat properties

321 Gelcoat and topcoat shall be produced of polyester satisfying the requirements in 300, Grade 1.

322 The resin must not contain more than 15% pigments and other filling compounds and shall cover completely at a thickness of maximum 500 µ.

323 For lifeboats, gelcoat and topcoat have to comply with the requirements given in Tables 300.3.

400 Sandwich core materials

410 General requirements

411 Core materials shall have stable long time properties; continuous chemical processes, diffusion, etc. shall not affect the physical properties of the material. If considered necessary documentation may be required.

412 On delivery the surface of the material shall be such that no further machining or grinding is required to obtain proper bonding of the material.

413 For core materials of particular composition or structure additional requirements may be introduced.

414 Core materials shall normally be compatible with resins based on polyester, vinylester and epoxy. Core materials with a limited compatibility may be accepted upon special consideration. Limitations will be specified in the certificate.

420 Properties

421 The approval of core materials is separated into two different quality grades:

Grade 1: Required quality of core materials for hull constructions.

Grade 2: Required quality of core materials for less critical applications.

The approval will be related to a set of physical properties which will be specified in the type approval certificate. The minimum properties are to be specified by the manufacturer and verified by the approval testing.

422 Requirements for core materials are given in Table 400.1.
500 Sandwich adhesives and cement

510 Properties

511 The approval will be related to a set of physical properties which will be specified in the type approval certificate. The minimum properties are to be specified by the manufacturer and verified by the approval testing. The properties to be specified on the certificate are given in Tables 500.1 and 500.2.

512 Requirements for uncured material are given in Table 500.1.

513 Requirements for cured material in the joint are given in Table 500.2.

600 Polyethylene and ABS

Note:
Not applicable to lifeboats

End of note

610 General

611 The approval is granted to the manufacturer who produces the raw material at the final stage before boat production. For rotational moulding the approval is granted to the granulate/powder manufacturer. For thermforming of sheets the approval is granted to the sheet manufacturer.

612 Checking of ageing properties is to be carried out on sheet of the material in question with those pigments etc. which are to be applied in the production.

613 The content of pigments is not to exceed 4% and are to be evenly distributed in the material. Any detrimental effect on the strength of the material is to be recorded.

614 The impact strength of the material at low temperatures is approved in relation to the fracture character at pendulum notch impact testing. Brittle character at temperatures above 0°C will not be accepted. If the transition between tough and brittle character is between 0°C and -20°C, the following statement is entered on the boat's certificate:
"The impact strength of the plastic material is reduced at low temperatures, and the boat should not be used in frosty weather."

615 The ability of the material to withstand heating by sunlight is subject to approval on the basis of the reduction in the material stiffness between 20°C and 65°C. A reduction in the shear modulus of the material greater than 80% will not be accepted. If the reduction is between 30% and 80%, the following statement is entered on the boat's certificate:
"The material softens at high temperatures and may be permanently deformed by long term loading at high temperatures."

620 Properties and documentation

621 Table 600.1 specifies requirements for properties and documentation.

622 The test specimens are to be taken from the material which is used in production, but the material should not be any weaker due to the manufacturing process.

623 The approval is to state the manufacturing process for which the material is approved.

630 Properties of polyethylene

631 Polyethylene shall comply with the requirements given in Table 600.2. The test specimens shall be taken from material manufactured in accordance with a method representative for the boat production.

640 Properties of ABS

641 ABS shall comply with the requirements given in Table 600.3. The test specimens shall be taken from material manufactured in accordance with a method representative for the boat production.

642 The sheet thickness is by approval testing and delivery control not to exceed the tolerance given in Figure 1.

![Figure 1 Tolerance on sheet thickness](image1)

The tolerance is to be based on measurements at 20 points evenly distributed over the width of the sheet. The average thickness is not to be less than the nominal sheet thickness.

643 Individual values for shrinkage during heating should not exceed the values given by Figure 2.

![Figure 2 Shrinkage during heating](image2)
644. The shrinkage of the sheet is checked by taking at least six specimens measuring about 300 x 300 mm from places evenly distributed over the width of the sheet. On each specimen the plate direction is to be indicated, and a circle of diameter 100 mm is marked. The specimens are then placed in talcum powder between metal plates for 30 minutes at a specified temperature. The metal plates are to have a thickness of 0.6 - 0.8 mm.

700 Buoyancy materials

710 Buoyancy materials for lifeboats

711 When inherent buoyant material is required, the material should be subjected to the tests prescribed in paragraph 2.7 (720) except that in paragraph 2.7.6.3 (722.3) high octane petroleum spirit should be substituted for diesel oil.

(IMO Res. A.689(17) Pt.1 6.2.2)

712 In addition to the test in 6.2.2 (711), specimens of the material should be immersed in each of the following for a period of 14 days under a 100 mm head:

1. two specimens in crude oil;

2. two specimens in fuel oil;

3. two specimens in diesel oil;

4. two specimens in high octane petroleum spirit; and

5. two specimens in kerosene.

(IMO Res. A.689(17) Pt.1 6.2.3)

713 The specimens should be tested as supplied by the manufacturer and at normal room temperature (approximately 18 degrees C).

(IMO Res. A.689(17) 6.2.4)

714 Two additional specimens, which have already been subjected to the temperature cycling tests, should be tested against high octane petroleum spirit and afterwards subjected to the water absorption test as prescribed in 2.7.5 (721) to 2.7.8 (724). (IMO Res. A.689(17) Pt.1 6.2.5)

715 The dimensions of the specimens should be recorded at the beginning and end of these tests.

(IMO Res. A.689(17) Pt.1 6.2.6)

716 The reduction of buoyancy must not exceed 5% and the specimens should show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities. (IMO Res. A.689(17) Pt.1 6.2.7)

720 Water absorption

721 The tests should be carried out in fresh water and the specimens should be immersed for a period of seven days under a 1.25 m head of water. (IMO Res. A.689(17) Pt.1 2.7.5)

722 The tests should be carried out:

1. on two specimens as supplied;

2. on two specimens which have been subjected to the temperature cycling as prescribed in 2.7.1 (725); and

3. on two specimens which have been subjected to the temperature cycling as prescribed in 2.7.1 (725) followed by the diesel oil test as prescribed in 2.4 (2.4.1 refers to 1.4, sec 731).

(IMO Res. A.689(17) Pt.1 2.7.6)

723 The specimens should be at least 300 mm square and be of the same thickness as used in the lifejacket. Alternatively, the entire lifejacket may be subjected to the test. The dimensions should be recorded at the beginning and end of these tests.

(IMO Res. A.689(17) Pt.1 2.7.7)

724 The results should state the mass in kilograms which each specimen could support out of the water after one and seven days immersion (the selection of a test method suitable for obtaining this result directly or indirectly is left to the discretion of the testing authority). The reduction of buoyancy should not exceed 16% for specimens which have been exposed to the diesel oil conditioning and must not exceed 5% for all other specimens. The specimens should show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities.

(IMO Res. A.689(17) Pt.1 2.7.8)

725 Six specimens should be alternately subjected for 8 h to surrounding temperatures of -30 degrees C and +65 degrees C. These alternating cycles need not follow immediately after each other and the following procedure, repeated for 10 cycles, is acceptable:

1. an 8 h cycle at +65 degrees C to be completed in one day; and

2. the specimens removed from the warm chamber that same day and left exposed under ordinary room conditions until the next day;

3. an 8 h cycle at -30 degrees C to be completed the next day; and

4. the specimens removed from the cold chamber that same day and left exposed under ordinary room conditions until the next day.

(IMO Res. A.689(17) Pt.1 2.7.1)
730 Oil resistance

731 One of the lifebuoys should be immersed horizontally for a period of 24 h under a 100 mm head of diesel oil at normal room temperature. After this test the lifebuoy should show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities. (IMO Res. A.689(17) Pt.1 1.4)

<table>
<thead>
<tr>
<th>Table 200.1 Glass fibre reinforcements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property</td>
</tr>
<tr>
<td>Moisture content</td>
</tr>
<tr>
<td>Loss on ignition</td>
</tr>
<tr>
<td>Weight per unit length of area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 300.1 Polyester products, liquid condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property</td>
</tr>
<tr>
<td>Density</td>
</tr>
<tr>
<td>Viscosity</td>
</tr>
<tr>
<td>Acid value</td>
</tr>
<tr>
<td>Monomer content</td>
</tr>
<tr>
<td>Mineral content</td>
</tr>
<tr>
<td>Gel time</td>
</tr>
<tr>
<td>Overall volume shrinkage</td>
</tr>
</tbody>
</table>
Table 300.2 Polyester products, cured unreinforced resin

<table>
<thead>
<tr>
<th>Property</th>
<th>Test method</th>
<th>Required values for approval testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td></td>
<td>Grade 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The manufacturer’s nominal value</td>
</tr>
<tr>
<td>Hardness</td>
<td>ASTM D 2583-1995</td>
<td>Minimum 35</td>
</tr>
<tr>
<td>Heat deflection temperature (H.D.T.)</td>
<td>ISO 75-1993 Method A</td>
<td>Minimum 70°C</td>
</tr>
<tr>
<td>Water absorption</td>
<td>ISO/R 62-1996</td>
<td>Maximum 80 mg</td>
</tr>
<tr>
<td></td>
<td>Specimen: 50x50x4 mm (+ 1x1x0.2) Artificial sea water (DIN 50906) Submersion time: 28 days</td>
<td></td>
</tr>
<tr>
<td>Tensile strength</td>
<td>ISO/R 527-1996</td>
<td>Minimum 50 N/mm²</td>
</tr>
<tr>
<td>Modulus of elasticity</td>
<td>ISO/R 527-1996</td>
<td>Minimum 3000 N/mm²</td>
</tr>
<tr>
<td>Fracture elongation</td>
<td></td>
<td>Minimum 2.0%</td>
</tr>
</tbody>
</table>

Additional requirements for lifeboats:

- Combustibility: ASTM D 2863-77 Oxygen index minimum 23

Table 300.3 Requirements for gelcoat & topcoat for lifeboats, ageing

<table>
<thead>
<tr>
<th>Property</th>
<th>Test method</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ageing (Topcoat &amp; Gelcoat)</td>
<td>24 weeks in Xenon weather-o-meter ISO 4892-1981 Alternatively 4 years exposure under controlled conditions outside ISO 4607-1978</td>
<td>No visible signs of crazing or outwash of matter. No dramatic colour changes.</td>
</tr>
</tbody>
</table>
### Table 300.4 Requirements for gelcoat & topcoat for lifeboats, flame spread and smoke density

<table>
<thead>
<tr>
<th>Property</th>
<th>Test method</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flame spread and smoke density</td>
<td>Nordtest method NT Fire 004</td>
<td>Grade 1: Smoke-gas-density on maximum 50%. Smoke gas-temperature that does not exceed &quot;Limit curve 1&quot; described by the following points on a time/temperature-diagram:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time (minimum)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grade: Smoke-gas-density on maximum 95%. Smoke gas-temperature that does not exceed &quot;Limit curve 2&quot; described by the following points on a time/temperature diagram:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time (minimum)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

**Comments:**

1) Grade 2 will normally be regarded as sufficient for most of the types and applications for lifeboats. Grade 1 indicates equivalence with fire retardant accommodation materials for ships.

2) The test shall be carried out on laminate as described in paragraph 244. The lay up and resin of the laminate shall be specified in detail in the approval certificate as this may influence the test result.

3) If the lay up and the resin of laminate in a lifeboat differ significantly from the tested laminate, a new fire test may be required.
### Table 400.1 Sandwich core materials

<table>
<thead>
<tr>
<th>Property</th>
<th>Test method</th>
<th>Required values for approval testing</th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property</td>
<td>Test method</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensile strength (N/mm²)</td>
<td>ASTM C 297-61(12)</td>
<td>0.8</td>
<td>0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensile modulus (N/mm²)</td>
<td></td>
<td>30</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compr. strength (N/mm²)</td>
<td>ISO 844-1978</td>
<td>0.7</td>
<td>0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compr. modulus (N/mm²)</td>
<td></td>
<td>30</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compr. strength (N/mm²)</td>
<td>ISO 844-1978</td>
<td>50% of value obtained at 25°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compr. modulus (N/mm²)</td>
<td></td>
<td>50% of value obtained at 25°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shear strength (N/mm²)</td>
<td>ISO 1922-1981</td>
<td>0.6</td>
<td>0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shear modulus (N/mm²)</td>
<td></td>
<td>12</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shear elongation (%)</td>
<td>ISO 1922-1981</td>
<td>Manufacturer’s specified min. value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water absorption (kg/m³)</td>
<td>ISO 2896</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water resistance (%)</td>
<td>ISO 50905</td>
<td>75</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density (kg/m³)</td>
<td>ISO 845: 1977</td>
<td>Manufacturer’s specified min. value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen index</td>
<td>ASTM D-2863</td>
<td>Stated value</td>
<td>Stated value</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Maximum speed of deformation, in millimetres per minute: 10% of the value of the measured initial thickness.

2) Dimension of specimen 50 x 50 mm x product thickness.

3) The core material is to be tested with and without a longitudinal adhesive joint. The joint is to be located at the midplane of the specimen, parallel to the steel supports and on equal distance to the supports.

4) The test is to be carried out on samples with a layer of suitable resin for stabilisation of the cell walls at the loaded surfaces.

5) Elongation at fracture or at the point where the load has fallen to 80% of its maximum value.
### Table 500.1 Sandwich adhesives, uncur ed

<table>
<thead>
<tr>
<th>Property</th>
<th>Test method</th>
<th>Required values for approval testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity</td>
<td>ASTM D 1084-63 method B (for free-flowing adhesives)</td>
<td>Manufacturer's nominal value</td>
</tr>
<tr>
<td>Overall volume shrinkage</td>
<td>ISO 3521-1990</td>
<td>Manufacturer's nominal value</td>
</tr>
</tbody>
</table>

• Also required on delivery

### Table 500.2 Sandwich adhesives, cured material

<table>
<thead>
<tr>
<th>Property</th>
<th>Test method</th>
<th>Required values for approval testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile strength (N/mm²)</td>
<td>ASTM C 297-61, (specimen: 5 x 5 cm, speed: 1 mm/minute)</td>
<td>Minimum 1.0</td>
</tr>
<tr>
<td></td>
<td>At 20°C:</td>
<td>Minimum 60% retained strength</td>
</tr>
<tr>
<td></td>
<td>At 50°C:</td>
<td></td>
</tr>
<tr>
<td>Tensile strength and fracture elongation</td>
<td>ISO 527 (Specimen thickness 4 mm) At -10°C, 20°C and 50°C</td>
<td>Manufacturer's nominal value</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 % for superstructure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.5 % for hull</td>
</tr>
<tr>
<td>Shear strength (N/mm²)</td>
<td>ISO 1922-1927 (20°C)</td>
<td>Minimum 0.4</td>
</tr>
<tr>
<td>Water resistance</td>
<td>4 weeks immersion in salt water (DIN 50905) at 40°C (Tensile testing according to ASTM C 297-61 (specimen: 5 x 5 cm, speed: 1 mm/minute, 20°C)</td>
<td>Minimum 80 % retained strength</td>
</tr>
</tbody>
</table>

Curing conditions shall be according to the manufacturer's specifications.

Detailed description of surface treatment and application procedure is required.

Approval may be refused for materials considered having a too low fracture elongation.

Curing shrinkage is relevant only for gap filling cements.
Table 600.1 Properties and documentation of PE and ABS

<table>
<thead>
<tr>
<th>Properties</th>
<th>Test method</th>
<th>Information to be submitted and required values for approval testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile properties</td>
<td>ISO/DIS 527-1985 (Test specimen type 2, 5-50 mm/minute)</td>
<td>Curve at 20°C and 65°C</td>
</tr>
<tr>
<td>Shear modulus</td>
<td>ISO 537-1980 (torsion pendulum)</td>
<td>Curve for temperature range -20°C to 65°C</td>
</tr>
<tr>
<td>Creep</td>
<td>ISO/R 899-1981 (carried out on at least 3 stress levels and 2 test pieces per level)</td>
<td>Isochronous stress-deformation diagram for 1000, 100, 10, 1 and 0,1 hours at 20°C and 65°C</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Fatigue test carried out with constant stress or deformation amplitude</td>
<td>Curves up to at least 100 000 loading cycles at 20°C</td>
</tr>
<tr>
<td>Hardness</td>
<td>ISO 868-1985 (Shore D)</td>
<td>Given at 20°C, read after 15 seconds</td>
</tr>
<tr>
<td>Pulling weight impact</td>
<td>ASTM D 3029-72 (method A). The radius of the drop hammer's striking surface is to be 12,5 mm</td>
<td>Fracture energy by visible crack as fracture criterion, given at 0°C and at 20°C and with relevant material thickness</td>
</tr>
<tr>
<td>Pendulum impact</td>
<td>With V-notch 45° in accordance with ISO 180-1982. For particularly flexible materials an alternative test method (pendulum impact strength) may be used</td>
<td>Fracture energy at 0°C as well as a description of fracture type. The notch impact strength is only stated for non-aged materials</td>
</tr>
<tr>
<td>Ageing</td>
<td>ISO 179-1982 (Charpy)</td>
<td>Plotted fracture energy for aged materials as a function of logarithmic time. The time is normally to cover 48 months natural ageing or 5000 hours accelerated ageing. A shorter time can be approved if the ageing process is clarified at an earlier stage.</td>
</tr>
<tr>
<td>Fuel resistance</td>
<td>Stressed material submerged in normal engine fuel</td>
<td>Description of surface cracking</td>
</tr>
<tr>
<td>Melk index</td>
<td>ISO 1133-1981 COND 18</td>
<td>To be given for polyethylene</td>
</tr>
<tr>
<td>Chemical resistance</td>
<td>ISO 175-1981</td>
<td>List of chemicals which may damage the material</td>
</tr>
<tr>
<td>Density</td>
<td>ISO 1183-1983 (Method D)</td>
<td>To be given for polyethylene</td>
</tr>
<tr>
<td>Oxygen index</td>
<td>ASTM D 2863-1977</td>
<td>Value</td>
</tr>
</tbody>
</table>
### Table 600.2 Properties of polyethylene

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement LDPE</th>
<th>Requirement MDPE</th>
<th>Unit</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>- 0,930</td>
<td>0,930 - 0,945</td>
<td>g/cm³</td>
<td></td>
</tr>
<tr>
<td>Melt index</td>
<td>Stated value + 1,0 Though maximum 3,5</td>
<td>As LDPE</td>
<td>g/10 min.</td>
<td></td>
</tr>
<tr>
<td>Tensile yield stress</td>
<td>minimum 7,5</td>
<td>minimum 13,0</td>
<td>N/mm²</td>
<td>At 20°C</td>
</tr>
<tr>
<td></td>
<td>minimum 4,5</td>
<td>minimum 8,0</td>
<td>N/mm²</td>
<td>At 65°C</td>
</tr>
<tr>
<td>Elasticity modulus in tensile yield</td>
<td>minimum 180</td>
<td>minimum 350</td>
<td>N/mm²</td>
<td>At 20°C</td>
</tr>
<tr>
<td>Tensile creep strength</td>
<td>maximum 2,5 at stress 2,0</td>
<td>2,0 at stress 3,0</td>
<td>%</td>
<td>Deformation after 100 hours at 20°C</td>
</tr>
<tr>
<td>Hardness</td>
<td>Stated value + 3</td>
<td>As LDPE</td>
<td>Shore D</td>
<td>Tested at 20°C and read after 15 seconds</td>
</tr>
<tr>
<td>Impact strength (drop test without notch)</td>
<td>minimum 15</td>
<td>minimum 15</td>
<td>J/mm thickness</td>
<td>Freely supported test piece 0°C</td>
</tr>
<tr>
<td>Notch impact strength (pendulum test with notch)</td>
<td>Not brittle fracture</td>
<td>Not brittle fracture</td>
<td>Visual</td>
<td>Required only for boats with single skins 0°C</td>
</tr>
<tr>
<td>Pore contents</td>
<td>maximum 15</td>
<td>As LDPE</td>
<td>% of thickness</td>
<td>In structural parts</td>
</tr>
<tr>
<td></td>
<td>maximum 20</td>
<td>As LDPE</td>
<td>% of thickness</td>
<td>In the boat elsewhere</td>
</tr>
<tr>
<td>Impact tensile strength of aged material</td>
<td>Not brittle fracture</td>
<td>Not brittle fracture</td>
<td>Visual</td>
<td>Aged material corresponding to 4 years' natural ageing, tested at 0°C and with a test speed 2·10⁻⁵ %/mm</td>
</tr>
</tbody>
</table>

### Table 600.3 Properties of ABS

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile yield stress</td>
<td>Maximum 30 N/mm² at 20°C</td>
</tr>
<tr>
<td></td>
<td>Minimum 18 N/mm² at 65°C</td>
</tr>
<tr>
<td>Modulus of elasticity</td>
<td>Minimum 1600 N/mm² at 20°C</td>
</tr>
<tr>
<td>Creep</td>
<td>Maximum 1,0% deformation after 100 hours at a stress of 7,0 N/mm² at 20°C</td>
</tr>
<tr>
<td>Bending fatigue strength</td>
<td>At deformation amplitude of 1% and frequency 0,5 Hz the material is to withstand 50 000 load cycles before fracture</td>
</tr>
<tr>
<td>Notch impact strength</td>
<td>Minimum 2 kJ/m² at 20°C in accordance with ISO 179-82 (Charpy) without notch</td>
</tr>
<tr>
<td>Impact strength (pendulum) of aged material</td>
<td>After ageing corresponding to 4 years' natural ageing, the material is to have a fracture energy of at least 2,5 kJ/m²</td>
</tr>
</tbody>
</table>

DeT NORSKE VERITAS
DET NORSKE VERITAS

Det Norske Veritas is an autonomous, independent Foundation with the objective of safeguarding life, property and the environment.

The DNV organisation comprises 300 offices in 100 countries, with a total of 4,400 employees.