PART 0 CHAPTER 2

INTRODUCTION TO CLASSIFICATION

JANUARY 1999

CONTENTS

<table>
<thead>
<tr>
<th>Sec.</th>
<th>Rule Preamble</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sec. 1</td>
<td>Rule Preamble</td>
<td>5</td>
</tr>
<tr>
<td>Sec. 2</td>
<td>Types of High Speed and Light Craft</td>
<td>8</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
CHANGES IN THE RULES

General
The present edition of the Rules includes amendments decided by the Board in December 1998, and supersedes the January 1997 edition of the same chapter.
The Rule changes come into force on 1 July 1999.
This chapter is valid until superseded by a revised chapter. Supplements will not be issued except for an updated list of minor amendments and corrections presented in the Pt.0 Ch.1 Sec.3. The introduction booklet is normally revised in January and July each year.
Revised chapters will be forwarded to all subscribers to the Rules. Buyers of reprints are advised to check the updated list of Rule chapters printed in Pt.0 Ch.1 Sec.1 to ensure that the chapter is current.

Comments to the rules may be sent by e-mail to rules@dnv.com
For subscription orders or information about subscription terms, please use distribution@dnv.com
Comprehensive information about DNV and the Society's services is found at the Web site http://www.dnv.com

© Det Norske Veritas
Computer Typesetting (FM+SGML) by Det Norske Veritas
Printed in Norway by GCS AS.

If any person suffers loss or damage which is proved to have been caused by any negligent act or omission of Det Norske Veritas, then Det Norske Veritas shall pay compensation to such person for his proved direct loss or damage. However, the compensation shall not exceed an amount equal to ten times the fee charged for the service in question, provided that the maximum compensation shall never exceed USD 2 million.
In this provision "Det Norske Veritas" shall mean the Foundation Det Norske Veritas as well as all its subsidiaries, directors, officers, employees, agents and any other acting on behalf of Det Norske Veritas.
**CONTENTS**

**SEC. 1 RULE PREAMBLE.......................................................... 5**
A. Introduction ............................................................................. 5
A 100 Purpose ............................................................................. 5
A 200 Terminology ...................................................................... 5
B. The Classification System ..................................................... 5
B 100 The classification process and its limitations ................. 5
B 200 Who needs classification? ? ............................................. 5
B 300 Recognition of the Society ................................................ 6
B 400 Safety at sea - Who is responsible? ................................. 6
B 500 Naval surface craft - Who is responsible ......................... 6
B 600 Classification of newbuildings ........................................... 6
B 700 Classification in the operational phase ............................. 6
B 800 Owner’s duties ................................................................. 7
C. Remuneration ......................................................................... 7
C 100 Fee system ...................................................................... 7
D. Classification Support ............................................................ 7
D 100 General ........................................................................... 7
D 200 Pre-contract support ....................................................... 7
D 300 In-service support .......................................................... 7
D 400 Limitations ..................................................................... 7

**SEC. 2 TYPES OF HIGH SPEED AND LIGHT CRAFT .............. 8**
A. Hull Configurations ............................................................. 8
A 100 Air-cushion vehicle (ACV) .............................................. 8
A 200 Hydrofoils (HYD) ........................................................... 8
A 300 Surface Effect Ships (SES) .............................................. 8
A 400 Catamarans (CAT) .......................................................... 8
A 500 Monohulls (MONO) ......................................................... 8
A 600 Wave piercers (WP) ....................................................... 8
A 700 Small Waterplane Area Twin Hull (SWATH) .................. 8
A 800 Airfoils (AIR) ............................................................... 8
B. Structural Materials ............................................................. 8
B 100 General ......................................................................... 8
B 200 Aluminium ..................................................................... 9
B 300 Fibre Composites ........................................................... 9
B 400 Steel ............................................................................... 9
C. Propulsion Systems .............................................................. 9
C 100 Submerged propellers ..................................................... 9
C 200 Surface piercing propellers ............................................. 9
C 300 Water jets ....................................................................... 9
C 400 Air propellerss .............................................................. 9
SECTION 1
RULE PREAMBLE

A. Introduction

A 100 Purpose

101 The preamble to the rules explains the system of classification, 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.

102 The information included in Ch.2 Sec.1 is not in any way to be understood as rule requirements.

A 200 Terminology

201 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 world wide 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.

202 The Society signifies DNV.

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

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

205 Client means the party having requested classification or having assumed ownership of a classed ship. In cases where owners have authorised another party to operate the ship on their behalf, such party is regarded as the client.

206 IMO is the International Maritime Organization.

207 IACS is the International Association of Classification Societies.

208 A Recognised Classification Society means a classification society which is a full or associate member of IACS.

209 Classification comprises those services rendered by the Society in accordance with the rules. Classification of ships is conducted in accordance with the requirements of the rules and any other standards to which reference therein may be made.

210 Assigning Class originally signified designation of the ship according to its standard in one of several classes, ranging from good to bad. Today only the highest class is assigned, comprising the main class, 1A1 or 1A2, and an obligatory additional class notation, e.g. Passenger, where applicable. Voluntary additional class notations may also be assigned covering special service, equipment or systems, e.g. E0, denoting periodically unattended machinery space.

211 The Classification Certificate is issued upon assignment or renewal of class. Its validity is five years subject to successful completion of annual and intermediate surveys.

212 Statutory Certificates means IMO Convention Certificates issued on behalf of, or by, National Authorities.

213 Approval, or Approved, denotes acceptance by the Society of plans/descriptions showing design solutions, arrangements and/or equipment to comply with the rules. The approval is manifested by the Society’s approval stamp.

214 Type Approval is a procedure for assessment of a design against the rule requirements or a standard within the framework of the rules.

The design is to be representative for the continuous production.

Guidance note:
The terms design assessment and production assessment are used to harmonise terminology with the EU terminology.

---end-of-Guidance-note---

Guidance note:
The term Type Examination is used when the conformity assessment of the design is according to EU Directives or against other standards where fitness for use onboard ships, MOUs or HSLC has not been evaluated.

---end-of-Guidance-note---

215 A Quality Audit is a systematic and independent examination to determine whether established work processes and quality systems are adhered to.

216 A Supplier or a Manufacturer, supplies materials, components, equipment and systems to newbuildings to be classed, or to classed ships in operation, whose production is subject to design approval, surveys and testing in accordance with the rules.

B. The Classification System

B 100 The classification process and its limitations

101 Classification is a system for safeguarding life and property at sea, and the environment due to operational consequences. It implies a process of verifying ship standards against a set of requirements. The requirements are laid down in the rules established by the Society. Classification has gained worldwide recognition as an adequate level of safety and quality.

102 Classification implies an activity, in which the ship is surveyed during construction on the basis of design approval, tested before being taken into service, and surveyed regularly during its whole operational life until it is scrapped. The aim is to verify that the required rule standard is built in, observed and maintained.

103 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. Classification implies that rule requirements are verified at regular intervals. It is the owner’s responsibility to maintain the ship so as to comply with the rules at all times.

104 The Society keeps complete files on all classed ships covering the documentation required by the rules. Reports will not be disclosed to any party, apart from the National Authorities involved, without the owners consent. The Society also undertakes all reporting to National Authorities required in connection with the safety certificates.

B 200 Who needs classification?

201 Classification serves as verification system for a number of parties who have special interest in the safety and quality of ships, such as:
— National Authorities, who accept ships for registry, or let ships into their territorial waters, need assurance that they are safe to sail on and represent a minimum hazard to their surroundings.
— Insurance underwriters require ships to be classed in order to give insurance.
— Owners, who need the technical standard of the rules as basis for building contracts and to document the ships’ standard when seeking insurance or financing, or when hiring out or selling the ship.
— Building yards and sub-contractors use the rules as a tool for design and construction, as required by their client.
— Finance institutions use classification as a documented indicator of the ships’ value.
— Charterers or cargo owners require confirmation of the ships’ standard before hire.

B 300 Recognition of the Society

301 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 contributes to a high level of staff competence.
— Continuous monitoring of a large classed fleet ensures valuable feedback from casualties, damage incidents and operational experience in general. Analyses of these data is 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.

B 400 Safety at sea - Who is responsible?

401 National law institutes National Authorities’ responsibility for the total safety control of ships flying the national flag. Classification cannot in any way relieve the National Authorities of that responsibility.

402 National Authorities may use the classification system and the Society’s worldwide survey station network as their executive branch for safety control. The convenience of this arrangement is proved by the fact that the Society has been delegated extensive authorisation to work and certify on behalf of the majority of the maritime nations of the world.

403 Compliance with the rules ensures that the basic convention requirements are fulfilled, and a valid classification certificate may serve as the basis for issuance of all safety certificates called for by the international maritime conventions. In addition, compliance with any special national requirements may be checked.

Owners and yards have the benefit of co-operating with one body in respect of surveys and issuance/renewal of all safety certificates.

404 The National Authorities on whose behalf the Society is working, normally expect surveyors of the Society to assume authority similar to that of their own governmental inspectors. As a consequence the Society’s surveyors are expected to take steps to stop a substandard ship from leaving port. This entails withdrawing safety certificates in co-operation with port authorities and local consular authorities of the flag country.

405 The classification system applied to delegated, statutory work offers the National Authorities regular monitoring of survey and certificate status of ships flying their flag. Verification of the Society’s work process and quality systems may also be carried out. In this way, national control is retained at the discretion of the authority involved.

B 500 Naval surface craft - Who is responsible

501 National law institutes the nation’s responsibility for the total safety control of a naval surface craft flying the nation’s flag. Classification cannot in any way relieve the nation’s navy for its responsibility for the craft and its crew.

502 The navy may use the classification system and the Society’s world wide survey station network as an element in its supervisory activity towards the craft. The convenience of this arrangement shall take advantage of the Society’s broad experience as a quality assurance body for craft.

503 Compliance with the rules ensures that basic safety requirements given by the Society are complied with, and a classification certificate may serve as an assurance for its fulfilment.

504 Naval surface craft are not subject to international regulations and a navy may wish to deviate from such requirements. This may be done under the classification system, provided the Society and the navy mutually accept such deviations. Such deviations will be identified in the "Appendix to the classification certificate" and by a special class notation identifying national individuality.

B 600 Classification of newbuildings

601 The builder initiates the process by submitting a request for 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.

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 classification requirements.

602 During the building period the Society will carry 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.

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.

603 When the Society is satisfied that the requirements specified for the ship in question have been met, the appropriate class will be assigned and confirmed by the issuance of a classification certificate. Provided the requirements for retention of class are complied with, the certificate will normally have a validity of five years.

B 700 Classification in the operational phase

701 Compliance with the rule requirements in the operational phase is verified by the Society through a system of periodic surveys. The most comprehensive survey is the one carried out in connection with the renewal of the five-yearly classifi-
cation certificate. During the five year period the ship undergoes annual and intermediate surveys covering various parts, equipment and systems, depending on the class assigned.

702 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.

703 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 ship. This assessment is based amongst other things on type, age and technical history of the ship.

704 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.

705 The Society’s Register Book is available for supplying information on ships’ main particulars and details of their classification.

B 800 Owner’s duties

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

— The ship has to be competently handled in accordance with the rules.
— The ship has to be maintained to rule standard at all times. Any Conditions of Class have to be carried out as specified.
— The ship 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.

802 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.

C. Remuneration

C 100 Fee system

101 Remuneration is normally based on a fee system, in which the Society invoices each type of survey 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 survey 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.

D. Classification Support

D 100 General

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

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

D 200 Pre-contract support

201 Co-operation with the Society early in the design stage, before classification 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 ship, 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.

D 300 In-service support

301 Similar services are given in connection with ships in operation. Alternative ways of repairs may be indicated, acceptable distributions of cargo and ballast to alleviate over-stressing may be computed in case of damage, stability may be investigated in order to carry grain, etc. These are typical examples.

D 400 Limitations

401 Two main restrictions prevail on the Society when undertaking classification support work:

— The Society does not carry out complete, conceptual design of ships. 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 for classification purposes.
— Information received from clients in connection with assignment of class is not disclosed and used in classification support work.
SECTION 2
TYPES OF HIGH SPEED AND LIGHT CRAFT

A. Hull Configurations

A 100 Air-cushion vehicle (ACV)

101 An Air-cushion vehicle (ACV) is a craft where the whole or a significant part of its weight can be supported, whether at rest or in motion, by a continuously generated cushion of air.

102 This type of craft is able to operate on sea and land and also on ice. The craft creates almost no waves.

103 Air propellers or jets are normally to be used. These may create noise and precise navigation may be difficult as wind affects the course of the craft.

104 Alternative versions with water propellers have been built and proved successful in operation at sea.

105 The air-cushion is normally enclosed by a rubber skirt which has to be maintained in service as the lower part is exposed to abrasion.

A 200 Hydrofoils (HYD)

201 A Hydrofoil (HYD) is characterized by the hull being lifted partly or fully out of the water during operating conditions by lifting forces generated by partly or fully submerged foils.

202 Hydrofoils have low accelerations in waves and low resistance at the service speed.

203 High power is required to get foilborne and the speed in heavy sea has to be reduced to displacement mode. The propulsion system is somewhat complicated as the craft operates above the waterlevel.

204 Active ride control system may be used to improve the comfort level.

205 Alternative versions may be moderate hydrofoils on catamarans giving some lift assistance and thereby reduce the resistance.

A 300 Surface Effect Ships (SES)

301 A Surface Effect Ships (SES) is an air-cushion vehicle whose walls extending along the sides are permanently immersed hard structures. Surface Effect Ships (SES) are also called side wall craft or air cushion catamarans.

302 A SES has low resistance and create moderate waves. The air-cushion reduces the accelerations onboard and water propulsion systems can be used.

303 Loss of speed in a seaway may be experienced as leakages from the air-cushion may affect the propulsion efficiency.

304 The air-cushion is enclosed by flexible or rigid skirts fore and aft and some abrasion of the skirt system may be experienced in service.

A 400 Catamarans (CAT)

401 A High speed catamaran. (CAT) is a planing or semi-planing craft with twin hulls. Some of its weight may be carried by dynamic lift. Catamarans may be both symmetric and asymmetric.

402 Catamarans normally perform well at low and medium high speed. The propulsion system may be simple and have favourable working conditions. The load carrying capacity may be good.

403 Increased resistance at very high speed may be experienced and some craft create waves at certain speeds.

404 Catamarans may be assisted by active or passive foils to improve performance.

A 500 Monohulls (MONO)

501 A High speed monohull (MONO) is a planing or semi-planing craft. Some of the weight may be carried by dynamic lift.

502 Stability and broaching should be specially considered.

503 Monohulls may be assisted by hydrofoils or airfoils to improve performance.

A 600 Wave piercers (WP)

601 A wave piercer (WP) is a twin hull vessel characterized by a large breadth/length ratio, and a relatively small waterplane area. The combination of large breadth and small waterplane area contributes to reducing rolling, piercing the waves instead of responding.

602 The craft is not affected by waves the same way as an ordinary catamaran.

603 The piercing effect is limited to a certain maximum waveheight. Above this level the upper hull structure will be affected by the waves. The concept is sensitive to loading condition.

604 The craft may be fitted with active or passive foil systems.

A 700 Small Waterplane Area Twin Hull (SWATH)

701 A SWATH is a twin hull craft characterized by small waterplane area at the operating draft.

702 The effect of waves is reduced due to the small waterplane area and thereby improving seakeeping performance.

703 A SWATH shall be operated at a specific draught and trim and may thereby be sensitive to the loading condition. Water ballast capacity is normally required.

704 Active foil systems are normally required.

A 800 Airfoils (AIR)

801 An Airfoil-craft (AIR) may be used as a conventional boat in the floating mode and as a ground effect airplane in the gliding mode just above the waterplane. The concept is also called a Ground Effect Vehicle or Ram Effect Vehicle.

802 Very high speeds may be achieved.

803 The safety aspects, when operating at such high speeds, will require special considerations.

B. Structural Materials

B 100 General

101 High speed and light craft requires light weight designs. Consequently, an optimal structural design may be a combination of various materials.

102 For craft utilizing a combination of different structural materials the requirements for each individual material apply. Special considerations may be required to make sure that the various materials work efficiently together. In particular different stiffness of the materials has to be considered.

DET NORSKE VERITAS
B 200 Aluminium

201 Approved marine grade aluminium materials may be applied for all main structural members. Marine grade is required also for windowframes, doors, hatches etc.

202 Aluminium is delivered in various alloys and tempers. It is important to take into consideration that the material properties are reduced in heat affected zones.

203 Rule requirements are given for welded aluminium constructions. Glued and riveted constructions may be accepted based on special considerations.

B 300 Fibre Composites

301 Fibre composites is a term used for a great variety of composite materials consisting of a fibre reinforcement embedded in a matrix material. In the rules, requirements are given for the most common component materials and their combinations. The properties of fibre composites are dependent on the component materials, the laminate construction and the fabrication process. The rules also describe general calculation methods and failure criteria for laminates based on single ply properties. However, actual properties will have to be verified by material testing.

Component materials for which acceptance criteria are not given in the rules will be individually considered case by case.

302 The matrix is the component material distributing the loads to the reinforcement fibres. Mostly polyesters are used, but both vinylesters, phenolics and epoxy resins are relevant materials. The Society type approves resins for application in high speed and light craft.

303 The reinforcement materials are mostly various qualities of glassfibres, but also carbon fibres and synthetic fibres are used. The strength and stiffness are depending on the orientation and application of the fibres in the laminates. Reinforcement materials are to be type approved.

304 In sandwich constructions various types of core materials are applicable. PVC cores are most common, but also polyurethane, balsa and various types of honeycomb materials may be used for a number of applications. Core materials are to be type approved.

B 400 Steel

401 As the size of high speed and light craft increases, steel becomes an alternative material to provide necessary stiffness.

402 Steel constructions require special corrosion protection as no corrosion allowance is included in the rule’s thickness requirements.

C. Propulsion Systems

C 100 Submerged propellers

101 Both fixed and variable pitch propellers are applicable on high speed and light craft.

102 It is most important to make sure that the propeller works in an even waterflow. The angle between the waterflow and the shaft should be as small as possible.

103 Various concepts are used, both traditional shafts and torpedos with propeller both fore and aft.

C 200 Surface piercing propellers

201 Both fixed and variable pitch surface propellers are applicable. The surface propeller has the shaft in the waterline and only a part of the propeller is submerged.

202 Surface propellers are efficient, in particular, at high speed.

C 300 Water jets

301 A water jet takes water into a duct, accelerates the water by a pump and sends a water jet out behind the boat above the waterline.

302 It is an efficient propulsion at medium and high speed, well protected inside the craft and with good manoeuvring qualities. It is somewhat sensitive to trap air into the duct and may pick up objects floating in the water or from the bottom at shallow depths in harbours.

C 400 Air propellers

401 Craft types operating above the water level, with no submerged parts, are normally fitted with air propellers in protecting ducts.