



GUIDE FOR BUILDING AND CLASSING

YACHTS 2018

NOTICES AND GENERAL INFORMATION

**American Bureau of Shipping
Incorporated by Act of Legislature of
the State of New York 1862**

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Notices and General Information

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Introduction

1. The year 2018 edition of the *Guide for Building and Classing Yachts* consists of the nine (9) booklets as shown in Table 1. With regard to three booklets, Part 1, Part 2, and Part 7:
 - a) The purpose of the generic title *ABS Rules for Conditions of Classification (Part 1)* is to reflect the expanded contents of PART 1, as a result of including consolidated requirements for “Classification” applicable to all types of and sizes of yachts. Additional specific requirements are contained in Chapters 2 and 3 of Part 1.
 - b) The purpose of the generic title *ABS Rules for Materials and Welding* of PART 2 is to emphasize the common applicability of the requirements to ABS-classed vessels, other marine structures and their associated machinery, and thereby make PART 2 more readily a common “PART” of various ABS Rules and Guides, as appropriate.
 - c) The purpose of the generic title *ABS Rules for Survey After Construction (Part 7)* is to reflect the expanded contents of PART 7, as a result of including consolidated requirements for “Surveys After Construction” applicable to all types and sizes of vessels, barges and specific shipboard arrangements/systems, etc., as specified in Part 7, Chapter 1, Section 1.
2. The numbering system applied in the Rules is shown in Table 2.
3. The effective date of each technical change since 1993 is shown in parenthesis at the end of the subsection/paragraph titles within the text of each Part. Unless a particular date and month are shown, the years in parentheses refer to the following effective dates:

(2000) and after	1 January 2000 (and subsequent years)	(1996)	9 May 1996
(1999)	12 May 1999	(1995)	15 May 1995
(1998)	13 May 1998	(1994)	9 May 1994
(1997)	19 May 1997	(1993)	11 May 1993
4. Until the next edition of the *Guide for Building and Classing Yachts* is published, Rule Change Notices and/or Corrigenda, as necessary, will be published on the ABS website – www.eagle.org – only, and will be available free for downloading. It is not intended to publish hard copies of future Rule Change Notices and/or Corrigenda to existing Rules or Guides. The consolidated edition of the *Guide for Building and Classing Yachts*, which includes Rule Change Notices and/or Corrigenda using different colors for easy recognition, will be published on the ABS website only when RCN and/or Corrigenda are issued.
5. The listing of CLASSIFICATION SYMBOLS AND NOTATIONS is available from the ABS website www.eagle.org for download.

TABLE 1
Applicable Editions of Booklets Comprising 2018 Guide

Notices and General Information	2018
Part 1: Rules for Conditions of Classification ⁽¹⁾	2018 ⁽²⁾
Part 1: Conditions of Classification (Supplement to the <i>ABS Rules for Conditions of Classification</i>) ⁽¹⁾	2018
Part 2: Rules for Materials and Welding Rules for Testing and Certification of Materials Rules for Welding and Fabrication	2018 ⁽²⁾
Part 2: Rules for Materials and Welding – Aluminum and Fiber Reinforced Plastics (FRP)	2018 ⁽²⁾
Part 3: Hull Construction and Equipment	2018
Part 4: Vessel Systems and Machinery	2018
Part 5: Specialized Yachts and Services	2018
Part 7: Rules for Survey After Construction	2018 ⁽²⁾

Notes:

- 1 The requirements for conditions of classification are contained in the separate, generic *ABS Rules for Conditions of Classification (Part 1)*. Additional specific requirements are contained in Part 1 of these Rules.
- 2 The latest edition of these Rules is to be referred to. These Rules may be downloaded from the ABS website at www.eagle.org, Rules and Guides, Downloads or may be ordered separately from the ABS Publications online catalog at www.eagle.org, Rules and Guides, Catalog.

TABLE 2
Division and Numbering of Rules and Guides

<i>Division</i>	<i>Number</i>
Part	Part 1
Chapter	Part 1, Chapter 1
Section	Section 1-1-1
Subsection (see Note 1)	1-1-1/1
Paragraph (see Note 1)	1-1-1/1.1
Subparagraph	1-1-1/1.1.1
Item	1-1-1/1.1.1(a)
Subitem	1-1-1/1.1.1(a)i
Appendix	Appendix 1-1-A1 or Appendix 1-A1-1

Note:

- 1 An odd number (1, 3, 5, etc.) numbering system is used for the Rules and Guides. The purpose is to permit future insertions of even-numbered paragraphs (2, 4, 6, etc.) of text and to avoid the necessity of having to renumber the existing text and associated cross-references, as applicable, within the Rules and associated process instructions, check sheets, etc.

Change Notice (2018)

TABLE 3
Summary of Changes from the 2017 Guide

EFFECTIVE DATE 1 July 2017 – shown as (1 July 2017)
(based on the contract date for new construction between builder and Owner)

<i>Part/Para. No.</i>	<i>Title/Subject</i>	<i>Status/Remarks</i>
PART 4	Machinery and Systems	
4-3-3/11.3.5 (New)	System Response Under Failure	To detect failure in the steering gear control system and provide the operator with sufficient information to decide what action is required for the different failure scenarios, in line with IACS UR E25 June 2016. (Incorporates Notice No. 1)
4-3-3/11.9.7	Low Oil Level Alarm	To detect failure in the steering gear control system and provide the operator with sufficient information to decide what action is required for the different failure scenarios, in line with IACS UR E25 June 2016. (Incorporates Notice No. 1)
4-3-3/11.9.12 (New)	Earth Fault	To detect failure in the steering gear control system and provide the operator with sufficient information to decide what action is required for the different failure scenarios, in line with IACS UR E25 June 2016. (Incorporates Notice No. 1)
4-3-3/11.9.13 (New)	Deviation	To require a deviation alarm in addition to basic failure detection, in line with IACS UR E25 June 2016. (Incorporates Notice No. 1)
4-4-1/9.19.3(c)	Fire Resistance	To clarify the cases in which flexible hoses need not be of fire-resistant type. (Incorporates Notice No. 1)
4-6-2/7.9	Harmonics	To specify that the harmonic distortion calculation report is to be kept on board for exceptions to the 8% limit in cases where all installed equipment and systems have been designed for higher THD levels, in line with IACS UR E24 June 2016. (Incorporates Notice No. 1)
4-6-2/9.18 (New)	Harmonic Distortion for Craft Electrical Distribution System including Harmonic Filters	To introduce requirements for survey of harmonic filters and harmonic distortion levels, in line with IACS UR E24 June 2016. (Incorporates Notice No. 1)
4-6-2/9.19	Protection of Harmonic Filter Circuits Associated with Electric Propulsion	To introduce requirements for survey of harmonic filters and harmonic distortion levels, in line with IACS UR E24 June 2016. (Incorporates Notice No. 1)
4-6-4/13.1.1	General	To identify the standards that have been withdrawn or replaced by new ones and to consider approaches for cables not manufactured to IEC standards identified, in line with IACS UR E7 Rev.4 Apr. 2016. (Incorporates Notice No. 1)
4-7-4/Table 4A	Monitoring of Propulsion Machinery – Slow Speed (Crosshead) Diesel Engines	To require turbocharger speed alarm for Categories B and C turbochargers, in line with IACS UR M35 rev. 7 Mar. 2016. (Incorporates Notice No. 1)
4-7-4/Table 4B	Monitoring of Propulsion Machinery – Medium/High Speed (Trunk Piston) Diesel Engines	To require turbocharger speed alarm for Categories B and C turbochargers, in line with IACS UR M35 rev. 7 Mar. 2016. (Incorporates Notice No. 1)
4-7-4/Table 6B	Instrumentation and Safety System Functions in Centralized Control Station – Generator Prime Mover for Electric Propulsion	To require turbocharger speed alarm for Categories B and C turbochargers, in line with IACS UR M35 rev. 7 Mar. 2016. (Incorporates Notice No. 1)
4-7-4/Table 7	Monitoring of Auxiliary Prime-movers and Electrical Generators	To require turbocharger speed alarm for Categories B and C turbochargers, in line with IACS UR M35 rev. 7 Mar. 2016. (Incorporates Notice No. 1)

EFFECTIVE DATE 1 September 2017 – shown as (1 September 2017)

<i>Part/Para. No.</i>	<i>Title/Subject</i>	<i>Status/Remarks</i>
PART 1	Conditions of Classification (Supplement to the ABS Rules for Conditions of Classification)	
1-1-3/3	Machinery	To better define the ~~✗~~ AMS notation as applicable to yachts and to introduce the ~~(✗)~~ AMS notation. (Incorporates Notice No. 2)

EFFECTIVE DATE 1 September 2017 – shown as (1 September 2017)
(based on the contract date for new construction between builder and Owner)

<i>Part/Para. No.</i>	<i>Title/Subject</i>	<i>Status/Remarks</i>
PART 5	Specialized Yachts and Services	
5-1-1/7.3	Machinery	To better define the ~~✗~~ AMS notation as applicable to yachts and to introduce the ~~(✗)~~ AMS notation. (Incorporates Notice No. 2)

EFFECTIVE DATE 1 January 2018 – shown as (2018)
(based on the contract date for new construction between builder and Owner)

<i>Part/Para. No.</i>	<i>Title/Subject</i>	<i>Status/Remarks</i>
PART 3	Hull Construction and Equipment	
3-1-1/3.1	Scantling Length (L)	To align the requirements with ICLL 1966/Reg. 3 & IACS UR S2.
3-1-1/3.3	Freeboard Length (L_f)	To align the requirements with ICLL 1966/Reg. 3 & IACS UR S2.
3-1-1/11.1	Freeboard Deck	To align the requirements with ICLL 1966/Reg. 3 & IACS UR S2.
3-2-9/Figure 3	Tapered Couplings	To be consistent with the requirements of 3-2-9/11.7.
3-2-9/17.5	Diaphragm Plates	To allow larger openings on diaphragm plates when the effects of openings are considered in the strength assessment.
3-3-A2 (Title)	Computer Software for Onboard Stability Calculations	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/5	Types of Stability Software	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/7.1	Calculation Program	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/7.5	Warning	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/7.15 (New)	Computer Model	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/7.17 (New)	Further Requirements for Type 4 Stability Software	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/Table 1	Acceptable Tolerances	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/11.1	Conditions of Approval of the Onboard Software for Stability Calculations	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/11.5	Specific Approval	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/15	Installation Testing	To align the Rules with IACS UR L5, Revision 3.
3-7-1	Tank, Bulkhead and Rudder Tightness Testing	To reflect the comments from Administrations, Industry Organizations and IMO considered during review of the proposed Testing Guidelines associated with SOLAS Chapter II-1, Regulation 11, reflected in IACS UR S14 (Rev.6, Sept 2016).

Notices and General Information

<i>Part/Para. No.</i>	<i>Title/Subject</i>	<i>Status/Remarks</i>
PART 4	Machinery and Systems	
4-5-2/11.1.2	Design	To clarify the requirements for the pressure rating of the distribution pipe.
4-5-2/11.1.3	Alarm	To align the requirements with IACS UI SC132 (Rev.4).
4-6-2/5.1.1	Location	To explicitly prohibit the installation of other unrelated equipment in the emergency generator room.
4-6-3/Table 1	Minimum Degree of Protection	To permit plugs and socket outlets installed in hazardous areas, in line with IEC 61892-7 Para. 8.11.1 and IEC 60079-14 Para. 5.13.
4-6-4/Table 6	Clearance and Creepage Distance for Switchboards, Distribution Boards, Chargers, Motor Control Centers and Controllers	To align the requirement with IEC 60092-302 and IEC 61892-3.
4-6-4/Table 7	Equipment and Instrumentation for Switchboard	To provide a reference to the requirements for high voltage systems.
4-6-5/1.3.5	Earth Fault Detection and Indication	To clarify the requirements for audible and visual indication of earth faults for high voltage systems.
4-7-1/5.47 (New)	Worst Case Execution Time (WCET)	To define terms used in 4-7-1/7.25, in line with ISO 17894:2005 and IEC 61508-3.
4-7-1/5.49 (New)	Worst Case Response Time (WCRT)	To define terms used in 4-7-1/7.25, in line with ISO 17894:2005 and IEC 61508-3.
4-7-1/7.25 (New)	Programmable Electronic System (PES)	To mitigate the danger of critical alarms missing their deadlines.
4-7-4/29.1.1	General	To clarify the number of bilge level switches/sensors required for vessels with ACC or ACCU notation, in line with IAC UR M27.
4-7-4/33.3.6	<No Title>	To require that weathertight doors fitted in the engine casing bulkhead also be a type of self-closing door or could be closed from fire control station, to prevent the release of CO ₂ from the unintentional remaining opened doors when fixed CO ₂ system in engine room is active and to align the requirements for a high-expansion foam fire extinguishing system with IACS UI SC262.



GUIDE FOR BUILDING AND CLASSING

YACHTS 2018

PART 1 CONDITIONS OF CLASSIFICATION (Supplement to the ABS Rules for Conditions of Classification)

**American Bureau of Shipping
Incorporated by Act of Legislature of
the State of New York 1862**

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Change Notice (2018)

The effective date of each technical change since 1993 is shown in parentheses at the end of the subsection/paragraph titles within the text of each Part. Unless a particular date and month are shown, the years in parentheses refer to the following effective dates:

(2000) and after	1 January 2000 (and subsequent years)	(1996)	9 May 1996
(1999)	12 May 1999	(1995)	15 May 1995
(1998)	13 May 1998	(1994)	9 May 1994
(1997)	19 May 1997	(1993)	11 May 1993

Listing by Effective Dates of Changes from the 2017 Guide

Notice No. 2 (effective on 1 September 2017) to the 2017 Guide, which is incorporated in the 2018 Guide, is summarized below.

EFFECTIVE DATE 1 September 2017 – shown as (1 September 2017)

<i>Part/Para. No.</i>	<i>Title/Subject</i>	<i>Status/Remarks</i>
1-1-3/3	Machinery	To better define the ⊗ AMS notation as applicable to yachts and to introduce the (⊗) AMS notation. (Incorporates Notice No. 2)

PART

1

Foreword

For the 2008 edition, Part 1, “Conditions of Classification” was consolidated into a generic booklet, entitled *Rules for Conditions of Classification (Part 1)* for all vessels other than those in offshore service. The purpose of that consolidation was to emphasize the common applicability of the classification requirements in “Part 1” to ABS-classed vessels, other marine structures and their associated machinery, and thereby make “Conditions of Classification” more readily a common Rule of the various ABS Rules and Guides, as appropriate.

Thus, this supplement specifies only the unique requirements applicable to yachts. This supplement is always to be used with the aforementioned *Rules for Conditions of Classification (Part 1)*.

PART

1

Conditions of Classification

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[See also separately published booklet <i>ABS Rules for Conditions of Classification (Part 1)</i>]		

PART

1

CHAPTER 1 Scope and Conditions of Classification

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PART

1

CHAPTER 1 Scope and Conditions of Classification

SECTION 1 Classification

The requirements for conditions of classification are contained in the separate, generic *ABS Rules for Conditions of Classification (Part 1)*.

Additional requirements specific to yachts are contained in the following Sections of this Part.

PART

1

CHAPTER 1 Scope and Conditions of Classification

SECTION 2 Application

1 Application

This Guide is applicable to pleasure yachts 24 meters (79 feet) or greater in length overall to 90 meters (295 feet) in length as defined in 3-1-1/3.

Yachts over 90 m (295 ft) in length and constructed of steel are to be classed in conjunction with the *ABS Rules for Building and Classing Steel Vessels (Steel Vessel Rules)*.

Yachts over 90 m (295 ft) in length and constructed of fiberglass reinforced plastic (FRP) or aluminum are to be classed in conjunction with the *ABS Rules for Building and Classing High Speed Craft (HSC Rules)*.

Pleasure yachts are self-propelled craft that are engaged exclusively in recreational, non-cargo handling, non-governmental, non-passenger service.

Commercial yachts are self-propelled craft that are chartered as motor, sailing, or motor-sailing yachts and are not considered by the Administration to be a SOLAS passenger vessel or an IMO HSC Code craft, do not carry more than 12 charter guests and do not carry cargo.

Passenger yachts are commercial or private yachts of any length, constructed of steel or aluminum, that are not considered by the Administration to be a SOLAS passenger vessel or an IMO HSC Code craft, that carry 13 to 36 passengers and do not carry cargo.

Approval and classification are given with the understanding that the yacht will be operated with good seamanship having regard to sea state, distance to safe refuge, loading, stability, safety and speed. Review and classification of the yacht are on condition that the speed is appropriately reduced with increasing sea conditions with regard to limiting dynamic hull responses on which design is based and review is carried out. The scope of operation is to be shown in the Operating Manual for the yacht. See 3-2-1/7 for operating manual requirements.

3 Government and Other Regulations

While this Guide covers the requirements for classification of new yachts, the attention of the owners, designers and builders is directed to the regulations of international, governmental, canal and other authorities dealing with those requirements in addition to or over and above the classification requirements.

PART

1

CHAPTER 1 Scope and Conditions of Classification

SECTION 3 Classification Symbols and Notations

A listing of Classification Symbols and Notations available to the Owners of vessels, offshore drilling and production units and other marine structures and systems, "List of ABS Notations and Symbols" is available from the ABS website "<http://www.eagle.org>".

The following notations are specific to the various types of yachts included in this Guide.

1 Hull

1.1 Pleasure Yachts

In accordance with 1-1-3/3 of the *ABS Rules for Conditions of Classification (Part 1)*, the classification **✕ A1 Yachting Service** will be assigned to vessels designed for pleasure yachting service and built to the applicable requirements in Part 3 and Part 4 and other relevant sections of this Guide. Motor yachts receiving a **Yachting Service** notation are permitted to operate with unlimited range geographically in association with voyages planned based on weather routing and with restrictions on significant wave height of 4.5 m (14.8 ft) for the *Operational Design Condition* and 6 m (19.7 ft) for the *Maximum Design Condition*. See also 1-1-4/1.1.

1.3 Restricted Service Yachts

In accordance with 1-1-3/3 of the *ABS Rules for Conditions of Classification (Part 1)*, the classification **✕ A1 Yachting Service R** will be assigned to vessels designed for restricted pleasure yachting service and built to the applicable requirements in Part 3 and Part 4 and other relevant sections of this Guide. Restricted service yachts are restricted to operate a distance from a place of refuge of not more than 200 nautical miles and with restrictions on significant wave height of less than 3.5 m (11.5 ft) for the *Operational Design Condition* and 4.5 m (14.8 ft) for the *Maximum Design Condition*. Voyages between 100 nautical miles and 200 nautical miles from a place of refuge must include voyage planning based on weather routing.

1.5 Commercial Yachts

In accordance with 1-1-3/3 of the *ABS Rules for Conditions of Classification (Part 1)*, the classification **✕ A1 Commercial Yachting Service** will be assigned to yachts built as noted in 1-1-3/1.1 which are chartered as motor, sailing, or motor-sailing yachts or carry passengers for revenue, are not considered by the Administration to be a SOLAS passenger vessel or an IMO HSC Code craft, do not carry more than 12 charter guests, do not carry cargo, and are built to the applicable requirements in Part 3, Part 4, Part 5, and other relevant sections of this Guide.

In addition to this Guide, Commercial Yachts are to comply with recognized statutory requirements for commercial yachts such as the UK MCA *The Large Commercial Yacht Code (LY3)*. Where a flag State has alternative requirements, statutory items may be considered to be in compliance with these requirements. This latter scope would normally include statutory items not normally within the scope of classification, such as Radio, Navigation Lights arrangement, Navigational Equipment, Accommodation-Medical Stores and Manning, Life Saving Appliances, etc. Commercial Yachts are not eligible for the restricted service notation **Yachting Service R**. Motor yachts receiving a **Commercial Yachting Service** notation are permitted to operate with unlimited range geographically in association with voyages planned based on weather routing and with restrictions on significant wave height of 4.5 m (14.8 ft) for the *Operational Design Condition* and 6 m (19.7 ft) for the *Maximum Design Condition*. See also 1-1-4/1.1.

1.7 Passenger Yachts

In accordance with 1-1-3/3 of the *ABS Rules for Conditions of Classification (Part 1)*, the classification **✘ A1 Passenger Yachting Service** will be assigned to yachts built as noted in 1-1-3/1.1 which are commercial or private yachts of any length, constructed of steel or aluminum, that are not considered by the Administration to be a SOLAS passenger vessel or an IMO HSC Code craft, that carry 13 to 36 passengers, do not carry cargo and are built to the applicable requirements detailed below:

- i) Class items are to be in accordance with Part 5C, Chapter 7 of the *Steel Vessel Rules* in regard to structural, mechanical, and electrical requirements. (Where considered appropriate based on the yacht's Rule Length *L*, parts of the *ABS Rules for Building and Classing Steel Vessels Under 90 Meters (295 Feet) in Length* may be applied.)
- ii) Statutory items are to be in compliance with MCA "REG 13-36 Passenger Yacht Code" for Red Ensign flag States or SOLAS Passenger vessel regulations (<36 passengers) for other flags not having their own code. Where a flag State has alternative requirements, statutory items may be considered to be in compliance with these requirements. The use of the REG Passenger Yacht Code by flag states other than Red Ensign is to be in accordance with the provisions of the REG Passenger Yacht Code.

Passenger yachts are to comply with the operational limits in the flag state Passenger Yacht Code.

For yachts receiving load line assignment, see Section 1-1-5 of the *ABS Rules for Conditions of Classification (Part 1)*.

3 Machinery (1 September 2017)

AMS is a classification notation that, together with the Maltese Cross **✘** symbol, indicates that a yacht's machinery, boilers and systems have been constructed and installed under ABS survey in accordance with the requirements of the ABS Rules. The **✘ AMS** notation is a mandatory requirement for all new construction yachts receiving the **Passenger Yachting Service** notation.

For all new construction yachts receiving the **✘ A1 Commercial Yachting Service** notation and for all new construction yachts over 61 m (200 ft) in length receiving the **✘ A1 Yachting Service** notation, the notation **(✘) AMS** may be assigned in lieu of **✘ AMS**, provided that all yacht's machinery, boilers and systems meet all the requirements for **✘ AMS** except for propulsion engines and their associated reduction gears, as well as auxiliary generators and their prime movers only.

Propulsion engines and their associated reduction gears, as well as auxiliary generators and their prime movers may be accepted based on Manufacturer's Work certificate and valid ABS Type Approval Certification, inclusive of Product Design Assessment (PDA) and Manufacturing Assessment (MA), as per Tier 3 definition in Appendix 1-1-A4 of the *ABS Rules for Conditions of Classification (Part 1)*. See also 1-1-3/Table 1 below.

TABLE 1 (1 July 2017)

<i>Machinery Notation</i>	<i>Design Approval</i>	<i>Certification of Propulsion Engines and Their Associated Reduction Gears, Auxiliary Generators and Their Prime Movers</i>
✘ AMS	ABS	ABS
(✘) AMS	ABS	1. ABS or 2. Manufacturer's certificate and ABS Type Approval Certificate inclusive of PDA and MA

ABS will accept **AMS** without the "✘" for new construction of non-commercial pleasure yachts less than 61 m (200 ft) in length with engines and gears which are design approved and not surveyed at the time of manufacture provided the engines and gears are issued with an ABS Interim Product Certificate (PQA).

5

Yachts not Built Under Survey

Yachts not built under ABS survey, but submitted for classification, are subjected to special classification surveys. Where found satisfactory and thereafter approved by the Committee, they are to be classed and distinguished in the *Record* by the applicable symbols and notation in 1-1-3/1 and 1-1-3/3 above, but the mark  signifying the survey during construction is to be omitted.

PART

1

CHAPTER 1 Scope and Conditions of Classification

SECTION 4 Rules for Classification

1 Application of Guide

1.1 General

This Guide is applicable to pleasure yachts intended for yachting service, in which sailing yachts may undertake long ocean voyages while motor yachts operate on shorter voyages in which the sea states and distance from safe refuge are considered. These operating conditions are addressed in the relevant parts of the Guide. Yachts engaged in chartering are to be in accordance with Part 3 and Part 4 and other relevant sections of this Guide as well as the applicable requirements of Part 5 of this Guide.

Yachting service operations are considered to be much less severe than those of ships in regular trade, to have limited yearly at-sea hours compared to their in port hours and to have special care and good maintenance by their owners and crew.

Where reference is made herein to the *ABS Rules for Building and Classing Steel Vessels (Steel Vessel Rules)*, the latest edition of those Rules is intended.

These requirements are applicable to those features that are permanent in nature and can be verified by plan review, calculation, physical survey or other appropriate means. Any statement in this Guide regarding other features is to be considered as guidance to the designer, builder, Owner, et al.

1.3 Application

The application of the Guide is, in general, based on its effective date and the contract date for construction between the shipbuilder and the prospective owner. (e.g., should the Guide have an effective date of 1 December 2014, it would not be applicable to a yacht for which the contract for construction was signed on 30 November 2014.) See also 1-1-4/3 of the *ABS Rules for Conditions of Classification (Part 1)*.

The effective date of this Guide is the first day of the month of publication.

PART

1

CHAPTER 1 Scope and Conditions of Classification

SECTION 5 Submission of Plans

Hull and machinery plans, as required below, are to be submitted to ABS for review and approval. Plans from designers and shipbuilders should generally be submitted electronically. However, hard copies will also be accepted. All plan submissions originating from manufacturers are understood to be made with the cognizance of the shipbuilder. A fee may be charged for the review of plans for which there is no contract of classification.

1 Hull Plans

Plans showing the arrangements, scantlings, details of principal parts of the hull structure and welding details of each yacht to be built under survey are to be submitted and approved before construction is commenced. These plans are also to include such particulars as the design draft, design speed and areas of intended operation. Where provision is to be made for any special type of loading conditions, particulars of the conditions are also to be given. In general, the plans as specified in 1-1-7/1 of the *ABS Rules for Conditions of Classification (Part 1)* are to be submitted for review or reference.

3 Machinery Plans and Data

Plans and data required to be submitted to ABS for review and approval are listed in 4-1-1/7 of this Guide.

5 Additional Plans

Additional plans to be submitted specific to commercial yachts are given in Section 5-1-1 of this Guide.

Also, where certification under 1-1-5/3 or 1-1-5/5 of the *ABS Rules for Conditions of Classification (Part 1)* is requested, submission of additional plans and calculations may be required.

7 Additional Requirements for FRP Yachts

For all FRP yachts, a “Building Process Description” and a “Quality Assurance Manual” is to be submitted for approval prior to the commencement of any lamination. See Section 2-6-3 of the *ABS Rules for Materials and Welding (Part 2) – Aluminum and Fiber Reinforced Plastics (FRP)*.

9 Additional Requirements for Wooden Yachts

For all wooden yachts, a “Building Process Description” and a “Quality Assurance Manual” is to be submitted for approval prior to the commencement of any lamination. See 3-2-7/9 of the *Yacht Guide* and Section 2-6-4 of the *ABS Rules for Materials and Welding (Part 2) – Aluminum and Fiber Reinforced Plastics (FRP)*.



GUIDE FOR BUILDING AND CLASSING

YACHTS 2018

PART 3 HULL CONSTRUCTION AND EQUIPMENT

**American Bureau of Shipping
Incorporated by Act of Legislature of
the State of New York 1862**

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Change Notice (2018)

The effective date of each technical change since 1993 is shown in parentheses at the end of the subsection/paragraph titles within the text of each Part. Unless a particular date and month are shown, the years in parentheses refer to the following effective dates:

(2000) and after	1 January 2000 (and subsequent years)	(1996)	9 May 1996
(1999)	12 May 1999	(1995)	15 May 1995
(1998)	13 May 1998	(1994)	9 May 1994
(1997)	19 May 1997	(1993)	11 May 1993

Listing by Effective Dates of Changes from the 2017 Guide

EFFECTIVE DATE 1 January 2018 – shown as (2018)

(based on the contract date for new construction between builder and Owner)

<i>Part/Para. No.</i>	<i>Title/Subject</i>	<i>Status/Remarks</i>
3-1-1/3.1	Scantling Length (<i>L</i>)	To align the requirements with ICLL 1966/Reg. 3 & IACS UR S2.
3-1-1/3.3	Freeboard Length (<i>L_f</i>)	To align the requirements with ICLL 1966/Reg. 3 & IACS UR S2.
3-1-1/11.1	Freeboard Deck	To align the requirements with ICLL 1966/Reg. 3 & IACS UR S2.
3-2-9/Figure 3	Tapered Couplings	To be consistent with the requirements of 3-2-9/11.7.
3-2-9/17.5	Diaphragm Plates	To allow larger openings on diaphragm plates when the effects of openings are considered in the strength assessment.
3-3-A2 (Title)	Computer Software for Onboard Stability Calculations	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/5	Types of Stability Software	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/7.1	Calculation Program	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/7.5	Warning	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/7.15 (New)	Computer Model	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/7.17 (New)	Further Requirements for Type 4 Stability Software	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/Table 1	Acceptable Tolerances	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/11.1	Conditions of Approval of the Onboard Software for Stability Calculations	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/11.5	Specific Approval	To align the Rules with IACS UR L5, Revision 3.
3-3-A2/15	Installation Testing	To align the Rules with IACS UR L5, Revision 3.
3-7-1	Tank, Bulkhead and Rudder Tightness Testing	To reflect the comments from Administrations, Industry Organizations and IMO considered during review of the proposed Testing Guidelines associated with SOLAS Chapter II-1, Regulation 11, reflected in IACS UR S14 (Rev.6, Sept 2016).

PART

3

Hull Construction and Equipment

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PART 3

CHAPTER 1 General

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CHAPTER 1 General

SECTION 1 Definitions

1 Application

The following definitions of terms apply throughout the requirements in this Guide.

3 Length

3.1 Scantling Length (L) (2018)

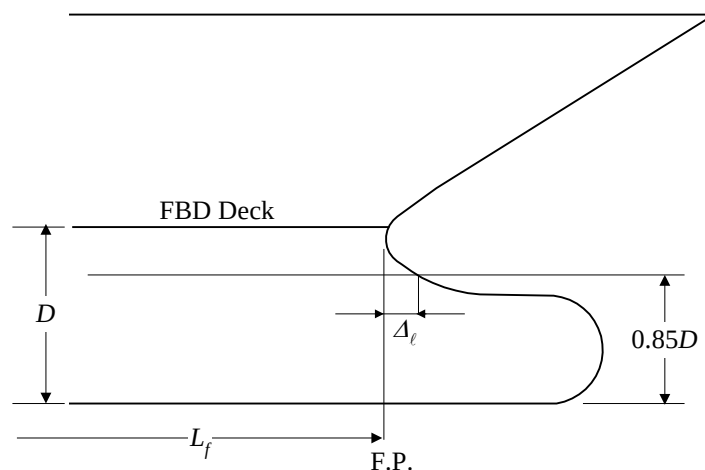
L is the distance in meters (feet) on the summer load line from the fore side of the stem to the centerline of the rudder stock. For use with this Guide, L is not to be less than 96% and need not be greater than 97% of the **extreme** length on the summer load line. The forward end of L is to coincide with the fore side of the stem on the waterline on which L is measured. Where a yacht is fitted with waterjet propulsion, or some other means of steering that eliminates the need for a conventional rudder, L is to be taken as 97% of the **extreme** length on the summer load line. L for sailing yachts is to be measured in accordance with 3-1-1/3.5.

3.3 Freeboard Length (L_f) (2018)

L_f is the distance in meters (feet) on a waterline at 85% of the least molded depth measured from the top of the keel from the fore side of the stem to the centerline of the rudder stock or 96% of the length on that waterline, whichever is greater. Where the stem is a fair concave curve above the waterline at 85% of the least molded depth and where the aftmost point of the stem is above the waterline, the forward end of the length, L_f , is to be taken at the aftmost point of the stem above that waterline. See 3-1-1/Figure 1.

In yachts designed with a raked keel, the waterline on which this length is measured is to be parallel to the designed waterline.

FIGURE 1



3.5 Scantling Length for Sailing and Motor-Sailing Yachts (L)

L is the scantling length, given by the following equation:

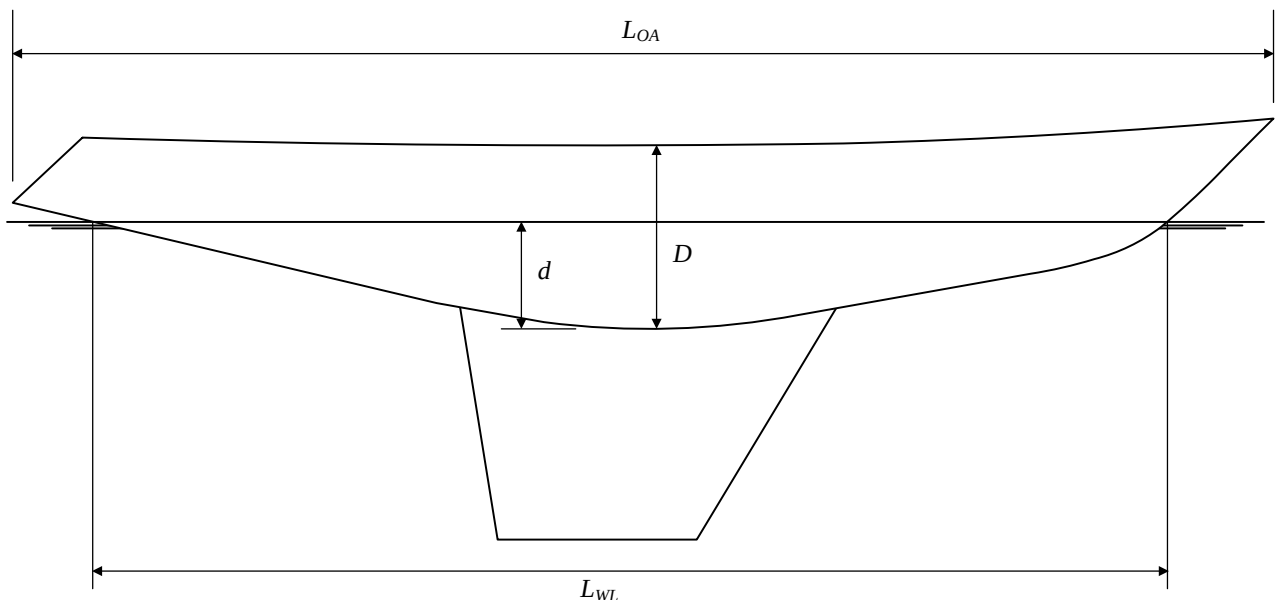
$$L = \frac{L_{OA} + L_{WL}}{2} \text{ meters (feet)}$$

where

L_{OA} = overall length of the hull. See 3-1-1/Figure 2.

L_{WL} = length on the maximum estimated displacement waterline. See 3-1-1/Figure 2.

FIGURE 2
Profile at Centerline



For motor sailing yachts with more of a chined, semi-planning or planning hull shape, L is to be measured in accordance with 3-1-1/3.1.

5 Breadth

B is the greatest molded breadth, in meters (feet).

Breadth used in 3-2-1/1.1.1 for yachts which have flare or tumblehome, is the mean breadth of the waterline breadth and the maximum breadth between the waterline and main deck at the longitudinal center of flotation (LCF).

7 Depth

7.1 Motor Yachts

D is the molded depth, in meters (feet), measured at the middle of the length L , from the molded keel line to the top of the freeboard deck beams at the side of the yacht. On yachts with rabbeted keel construction, (See 3-1-1/27) D is to be measured from the rabbet line. In cases where watertight bulkheads extend to a deck above the freeboard deck and are to be recorded in the *Record* as effective to that deck, D is to be measured to the bulkhead deck.

7.3 Sailing and Motor Sailing Yachts

D is the molded depth, in meters (feet), measured at the middle of the length L , from the bottom of the canoe hull at its lowest point at centerline to the top of the freeboard deck beams at the side of the yacht. For motor sailing yachts with more of a chined, semi-planning or planning hull shape, D is to be measured in accordance with 3-1-1/7.1.

9 Draft for Scantlings

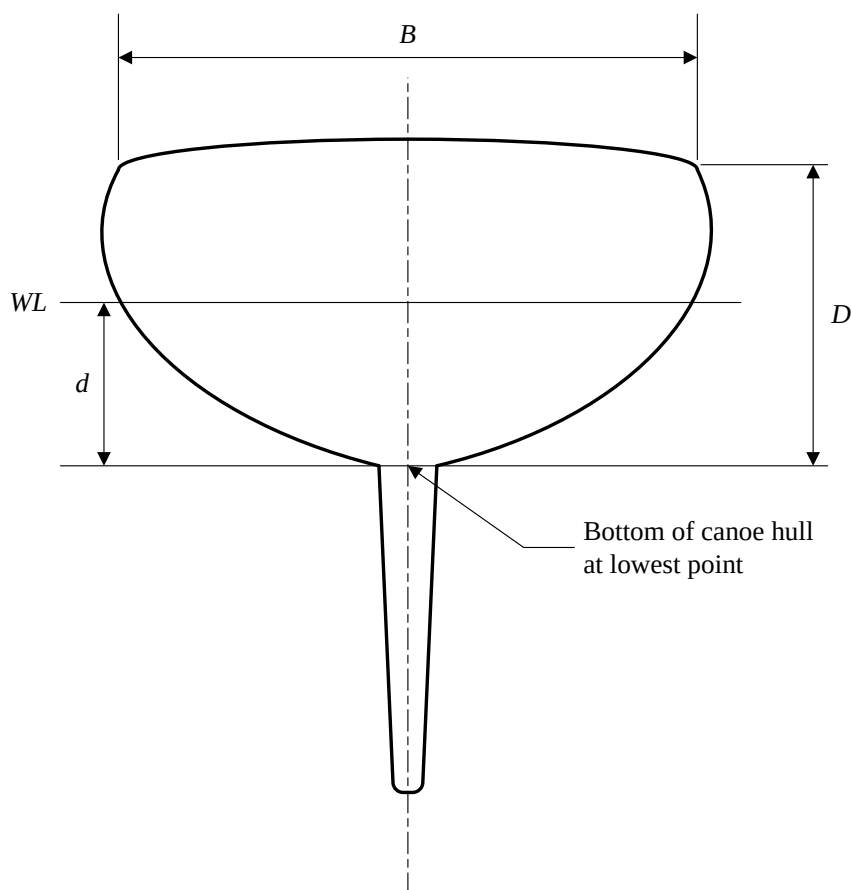
9.1 Motor Yachts

d is the draft, in meters (feet), measured at the middle of the length L from the molded keel or the rabbet line (see 3-1-1/27) at its lowest point to the estimated summer load waterline or the design load waterline in the displacement mode.

9.3 Sailing and Motor Sailing Yachts

d is the draft, in meters (feet), measured at the middle of the length L , from the bottom of the canoe hull at its lowest point at centerline to the maximum estimated displacement waterline. See 3-1-1/Figure 3. For motor sailing yachts with more of a chined, semi-planning or planning hull shape, d is to be measured in accordance with 3-1-1/9.1.

FIGURE 3
Transverse Section at D



11 Decks

11.1 Freeboard Deck (2018)

The freeboard deck is normally the uppermost **complete deck exposed to weather and sea, which has permanent means of closing all openings** in its weather portions, and below which all openings in the yacht side are equipped with permanent means for watertight closure.

In cases where a yacht is designed for a special draft considerably less than that corresponding to the least freeboard obtainable under the International Load Line Regulations, the freeboard deck for the purpose of this Guide may be taken as the lowest actual deck from which the draft can be obtained under those regulations.

11.3 Bulkhead Deck

The bulkhead deck is the highest deck to which watertight bulkheads extend and are made effective.

11.5 Strength Deck

The strength deck is the deck which forms the top of the effective hull girder at any part of its length. See Section 3-2-1.

11.7 Superstructure Deck

A superstructure deck is a deck above the freeboard deck to which the side shell plating extends or of which the sides are fitted inboard of the hull side not more than 4% of the breadth, B . Except where otherwise specified, the term superstructure deck where used in this Guide refers to the first such deck above the freeboard deck.

13 Superstructure

A superstructure is an enclosed structure above the freeboard deck having side plating as an extension of the shell plating, or not fitted inboard of the hull side more than 4% of the breadth B .

15 Deckhouses

A deckhouse is an enclosed structure above the freeboard deck, having side plating set inboard of the hull side-shell plating more than 4% of the breadth B of the yacht.

17 Displacement and Block Coefficient

17.1 Displacement

The displacement Δ , is the mass displacement of the yacht in the design condition in tonnes (long tons), unless otherwise specifically noted.

17.3 Block Coefficient (C_b)

C_b is the block coefficient obtained from the following equation:

$$C_b = \Delta / 1.025 L B_{wl} d \quad (\text{SI \& MKS units})$$

$$C_b = 35 \Delta / L B_{wl} d \quad (\text{US units})$$

where

Δ = displacement, as defined in 3-1-1/17.1

L = scantling length, as defined in 3-1-1/3

d = draft, as defined in 3-1-1/9

B_{wl} = greatest molded breadth at the draft, as defined in 3-1-1/9

19 Gross Tonnage

The measurement of the internal volume of spaces within the yacht as defined by the International Convention on Tonnage Measurement of Ships, 1969.

21 Deadweight (DWT)

For the purpose of this Guide, deadweight (*DWT*), is the difference, in metric tons (long tons), between the displacement of the yacht at its summer load line or the yacht with all tanks filled, maximum stores, and personnel or passengers and their effects on board, in water having a specific gravity of 1.025, and the unloaded weight of the yacht. For the purpose of this Guide, the unloaded weight is the displacement of the yacht, in tones (long tons), with no fuel, lubricating oil, ballast water, fresh water nor feed water in tanks, no consumable stores, and no personnel or passengers nor their effects.

23 Significant Wave Height

Significant wave height is the average height of the one-third highest observed wave heights over a given period.

25 Speed

Speed is the design speed in knots with the yacht running ahead at the maximum continuous rated shaft rpm and at the summer load waterline. Operational speed is 90% of design speed.

27 Rabbet Line (Fiber Reinforced Plastic)

The rabbet line is the line intersection between the outside of a yacht's bottom and a yacht's keel. Where there is no keel, the rabbet line is the bottom of the yacht.

29 Administration

The government of the state whose flag the yacht is intended to fly.

31 Fiber-Reinforced Plastic (FRP)

FRP consists of two basic components: a glass-filament or other material fiber reinforcement and a plastic, or resin, in which the reinforcing material is imbedded.

31.1 Reinforcement

Reinforcement is a strong, inert material bonded into the plastic to improve its strength, stiffness and impact resistance. Reinforcements are usually fibers of glass (a lime-alumina-silicate composition having a low alkali content) or other approved material such as aramid or carbon fiber, in a woven or non-woven form, with a strong adhesive bond to the resin.

31.1.1 Strand

A bundle of continuous filaments combined in a single, compact unit.

31.1.2 Roving

A band or ribbon of parallel strands grouped together.

31.1.3 Yarn

A twisted strand or strands suitable for weaving into a fabric.

31.1.4 Binder

The agent applied in small quantities to bond the fibers in mat form.

31.1.5 Coupling Agent

An active water soluble chemical that allows resin to adhere to glass.

31.1.6 Chopped-strand Mat

A blanket of randomly oriented chopped-glass strands held together with binder.

31.1.7 Woven Roving

A coarse fabric woven from rovings.

31.1.8 Cloth

A fabric woven from yarn

31.1.9 Peel-Ply

Fabric used as a protective covering on a laminate being prepared for a secondary bond to keep foreign particles from adhering to the surface.

31.1.10 Uni-directional

A woven or non-woven reinforcement with substantially more fibers in one principal axis of the reinforcing ply.

31.1.11 Double Biased

A woven or non-woven reinforcement with fibers primarily at $+45^\circ$ to the principal axes of the reinforcing ply.

31.1.12 Knitted or Stitched Fabrics

Two or more layers of unidirectional fabrics that are stitched together.

31.1.13 Bi-axial Fabric

A stitched or knitted reinforcement with fibers primarily in the two principal axes of the reinforcing ply.

31.1.14 Tri-axial Fabric

A stitched or knitted reinforcement with fibers running in one principal axis of the ply and in addition, with fibers running at $+$ and -45° to the warp.

31.1.15 Ply Principal Axes

The two principal axes of a reinforcing ply are the axis that is parallel to the warp and the axis that is parallel to the fill.

31.1.16 Warp

The roving or yarn running lengthwise in woven fabric (in the "roll direction").

31.1.17 Fill, Weft or Woof

The roving or yarn running at right angles to the warp in a woven fabric.

31.1.18 "E" glass

A family of glass reinforcement material of aluminoborosilicate composition and having high electrical resistivity.

31.1.19 "S" or "R" glass

A family of glass reinforcement material of magnesium aluminosilicate composition that contains a higher silicon content and provides higher strength and stiffness properties than "E" glass.

31.1.20 Aramid

A class of strong heat resistance synthetic fibers. (e.g., Kevlar®).

31.1.21 Carbon Fiber

A reinforcement material made of mostly carbon produced by the pyrolysis of organic precursor fibers in an inert environment.

31.3 Resin

Resin is a highly reactive synthetic that in its initial stage is a liquid, but upon activation is transformed into a solid.

31.3.1 Accelerator

A material that, when mixed with a catalyst or resin, speeds the cure time.

31.3.2 Additive

A substance added to another substance, usually to improve properties, such as plasticizers, initiators, light stabilizers and flame retardants.

31.3.3 Catalyst or Initiator

A material that is used to activate resin, causing it to harden.

31.3.4 Crazing

Hairline cracks, either within or on the surface of resin, caused by mechanical or thermal stresses.

31.3.5 Cure

To change resin from a liquid to a solid.

31.3.6 Cure time

The time required for resin to change from a liquid to a solid after a catalyst has been added.

31.3.7 Exothermic Heat

The heat given off as the result of the action of a catalyst on resin.

31.3.8 Filler

A material added to resin to modify its working properties or other qualities, or to lower densities.

31.3.9 Gel

A partially cured resin in a semi-solid state similar to gelatin in consistency.

31.3.10 Gel Time

The time required to change a flowable, liquid resin into a nonflowing gel.

31.3.11 Inhibitor

A material that retards activation or initiation of resin, thus extending shelf life or influencing exothermic heat or gel time.

31.3.12 Polymerization

The reaction that takes place when resin is activated or initiated.

31.3.13 Pot Life

The length of time that a catalyzed resin remains workable.

31.3.14 Shelf Life

The length of time that an uncatalyzed resin maintains its working properties while stored in a tightly sealed, opaque container.

31.3.15 Tack

The degree of stickiness of the resin.

31.3.16 Thixotropy

The property or phenomenon, exhibited by some resins, of becoming jelly-like at rest but becoming fluid again when stirred or agitated. This facilitates the application of the resin to inclined or vertical surfaces

31.3.17 Polyester Resin

A thermosetting resin that is formed by combining saturated and unsaturated organic acids. Such as orthophthalic and isophthalic acids.

31.3.18 Vinylester Resin

A thermosetting resin that consists of a polymer chain and an acrylate or methacrylate termination.

31.3.19 Epoxy

A resin that contains one or more of the epoxide groups.

31.5 Laminate

A laminate is a material composed of successive bonded layers, or plies, of resin and fiber or other reinforcing substances.

31.5.1 Bi-directional Laminate

A laminate having essentially the same strength and elastic properties in the two plane principal axes. Bi-directional laminates may be constructed of bi-axial, double bias, tri-axial, mat or unidirectional reinforcing layers, or a combination of any of these.

31.5.2 Uni-directional Laminate

A laminate with substantially more of the fibers in the plane of the laminate oriented in one of the two principal axis of the laminate plane so that the mechanical properties along that axis are appreciably higher than along the other natural axis.

31.5.3 Sandwich Laminate

A laminate consisting of two fiber reinforced plastic skins attached to a non-structural or structural core (see 3-1-1/31.7 "Encapsulation").

31.5.4 Barcol Hardness

A measurement of the hardness of a laminate and thereby the degree of completion of the cure.

31.5.5 Delamination

The separation of the layers of material in a laminate.

31.5.6 Gel Coat

The first resin applied to mold when fabricating a laminate to provide a smooth protective surface for the laminate.

31.5.7 Layup

The process of applying to a mold the layers of resin and reinforcing materials that make up a laminate. These materials are then compressed to eliminate entrapped air and to spread resin evenly. Also a description of the component materials and geometry of a laminate.

31.5.8 Verified Minimum Mechanical Property

The mechanical properties, in Part 2, Chapter 6 of the *ABS Rules for Materials and Welding (Part 2) – Aluminum and Fiber Reinforced Plastics (FRP)*, of laminates differing from the basic, verified by the appropriate test(s) listed in 2-6-1/Table 2.

31.5.9 Laminate Principal Axes

The two principal axes of a square or rectangular plate panel are for the application of this Guide those perpendicular and parallel to the plate panel edges.

31.5.10 Vacuum Bagging

A method used to apply a uniform pressure over an area by applying a vacuum to that area.

31.5.11 Resin Impregnation

A process of construction for large layers of fabric that consists of running a roll of fabric through a resin bath to completely saturate the fabric.

31.5.12 Resin Transfer Molding

A closed mold method that mechanically pumps resin through dry fabric previously placed in the mold.

31.5.13 Resin Infusion

A method of FRP construction that uses a vacuum to pull catalyzed resin through dry fabric.

31.5.14 Primary Bond

The bond that is formed between two laminated surfaces when the resin on both surfaces has not yet cured.

31.5.15 Secondary Bond

The bond that is formed between two laminated surfaces when the resin on one of the two surfaces has cured.

31.5.16 Post Cure

The act of placing a laminate in an autoclave and raising the temperature to assist in the cure cycle of the resin.

31.5.17 Autoclave

A large oven used in post curing large laminated parts.

31.7 Encapsulation

The containment of a core material, such as softwoods, plywood, balsa, PVC (cross linked) or linear polymer, within FRP laminates. The cores may be structurally effective or ineffective.

31.7.1 Bedding Putty

Material used to adhere the core material to the FRP skins.

31.7.2 Scores

Slits cut into the core material to aid in forming the core to complex shapes.

33 Wood

33.1 Modulus of Rupture in Bending

A reflection of the maximum load carrying capacity. It is obtained by the maximum bending moment that can be carried without rupture divided by the minimum section modulus of the plating or stiffening member. Values given are generally for the bending stress parallel to the grain.

33.3 Modulus of Elasticity

The number used to calculate the distance a plate or stiffening member will deflect under a given bending load. Values given are generally for the bending stress parallel to the grain.

33.5 Tensile Strength Parallel to Grain

The maximum stretching load, parallel to the grain, that a plate or stiffening member can withstand without rupture. As relatively few data are available for this property it may be conservatively estimated, for clear, straight grained wood, by the modulus of rupture in bending.

33.7 Tensile Strength Perpendicular to Grain

The maximum stretching load, perpendicular to the grain, that a plate or stiffening member can withstand without rupture.

33.9 Compressive Strength

A reflection of the maximum compressive load a plate or stiffening member can with-stand without crushing. It is obtained by the maximum load that can be carried without crushing divided by the cross-sectional area of the plate or stiffening member. Values given are generally for the compressive stress parallel to the grain.

33.11 Cold-molded Wood Laminate

Cold-molded wood laminate is formed of thin layers of the same or similar property woods, laid on a hull mold formed by the framing, generally with alternate layers running parallel to each other and with adjacent layers perpendicular to each other. The layers are in general not to be thicker than $\frac{1}{3}$ the overall laminate thickness, or 4.5 mm ($\frac{3}{16}$ in.) if less, the grain of wood is to be parallel to the length of the layer. Each layer of wood is coated on the faying surfaces with resin or glue before being placed on the hull mold.

33.13 Softwood

Softwoods are botanically named Gymnosperms, and fall into the category called conifers, having the seeds exposed, usually in cones.

33.15 Hardwoods

Hardwoods are botanically named Angiosperms. They have true flowers and broad leaves and the seeds are enclosed in fruit.

33.17 Plywood

A type of manufactured wood panel consisting of thin plies called veneers glued and pressed together. The direction of the grain of each ply is alternated 0/90 degrees from its adjacent layers and is parallel to the edges of the panel. In any plywood panel there is always an odd number of plies making up the panel because the grain of the top and bottom plies is always in the same direction. For marine plywood applications there must be a minimum of 5 plies.

35 Units

This Guide is written in three systems of units: SI units, MKS units and US customary units. Each system is to be used independently of any other system.

Unless indicated otherwise, the format of presentation in this Guide of the three systems of units is as follows:

SI units (MKS units, US customary units)

PART

3

CHAPTER 1 General

SECTION 2 General Requirements

1 Materials

This Guide is intended for welded yachts constructed of steel, welded yachts constructed of aluminum, and fiber reinforced plastic (FRP) yachts; complying with the requirements of Part 2, Chapters 1 and 2, 5, and 6 of the *ABS Rules for Materials and Welding (Part 2)*, respectively. The use of materials other than those specified in Part 2, Chapters 1, 2, 5, and 6 and the corresponding scantlings will be specially considered.

1.1 Selection of Material Grade

For yachts 61 m (200 ft) and over in length, steel materials are not to be lower grades than those required by 3-1-2/Table 1 for the material class given in 3-1-2/Table 2 for the particular location.

TABLE 1
Material Grades (2017)

Thickness (<i>t</i>) mm (in.)	Material Class	
	<i>I</i>	<i>II</i>
$t \leq 15$ ($t \leq 0.60$)	A ⁽¹⁾ , AH	A, AH
$15 < t \leq 20$ ($0.60 < t \leq 0.79$)	A, AH	A, AH
$20 < t \leq 25$ ($0.79 < t \leq 0.98$)	A, AH	B, AH
$25 < t \leq 30$ ($0.98 < t \leq 1.18$)	A, AH	D, AH
$30 < t \leq 35$ ($1.18 < t \leq 1.38$)	B, AH	D, AH
$35 < t \leq 40$ ($1.38 < t \leq 1.57$)	B, AH	D, AH
$40 < t \leq 51$ ($1.57 < t \leq 2.00$)	D, AH	E, DH

Notes:

- (2017) ASTM A36 steel otherwise manufactured by an ABS approved steel mill, tested and certified to the satisfaction of ABS may be used in lieu of Grade A for a thickness up to and including 12.5 mm (0.5 in.) for plate and 15 mm (0.6 in.) for sections.

TABLE 2
Material Class of Structural Members (2017)

Structural Members	Material Class	
	Within 0.4L Amidships	Outside 0.4L Amidships
Shell		
Bottom plating including keel plate	II	A ⁽³⁾ /AH
Bilge strake	II	A ⁽³⁾ /AH
Side Plating	I	A ⁽³⁾ /AH
Sheer Strake at strength deck ⁽¹⁾	II	A ⁽³⁾ /AH
Decks		
Strength deck plating ⁽²⁾	II	A ⁽³⁾ /AH
Stringer plate in strength deck ⁽¹⁾	II	A ⁽³⁾ /AH
Strength deck strake on tankers at longitudinal bulkhead	II	A ⁽³⁾ /AH
Strength deck plating within line of hatches and exposed to weather, in general	I	A ⁽³⁾ /AH
Longitudinal Bulkheads		
Lowest strake in single bottom yachts	I	A ⁽³⁾ /AH
Uppermost strake including that of the top wing tank	II	A ⁽³⁾ /AH
Other Structures in General		
External continuous longitudinal members and bilge keels	II	A ⁽³⁾ /AH
(1 July 2015) Plating materials for stern frames supporting rudder and propeller boss, rudders, rudder horns, and shaft brackets	-	I
Strength members not referred to in above categories and above local structures	A ⁽³⁾ /AH	A ⁽³⁾ /AH

Notes:

- 1 A radius gunwale plate may be considered to meet the requirements for both the stringer plate and the sheer strake, provided it extends suitable distances inboard and vertically. For formed material see 2-4-1/3.13 of the *ABS Rules for Materials and Welding (Part 2)*.
- 2 Plating at the corners of large hatch openings are to be specially considered.
- 3 (2017) ASTM A36 steel otherwise manufactured by an ABS approved steel mill, tested and certified to the satisfaction of ABS may be used in lieu of Grade A for a thickness up to and including 12.5 mm (0.5 in.) for plate and up to and including 19 mm (0.75 in.) for sections.

1.3 Note for the Users

The attention of users is drawn to the fact that when fatigue loading is present, the effective strength of higher-strength steel in a welded construction may not be greater than that of ordinary-strength steel. Precautions against corrosion fatigue to higher strength steel and aluminum alloy materials may also be necessary.

1.5 Structures Exposed to Low Air Temperatures (2017)

For yachts intended to operate in areas with low air temperatures [below and including -20°C (-4°F)], the materials in exposed structures are to be selected based on the design temperature t_D , to be taken as defined in 3-1-2/1.7.

Materials in the various strength members above the lowest ballast water line (BWL) exposed to air are not to be of lower grades than those corresponding to Classes I, II and III, as given in 3-1-2/Table 3, depending on the categories of structural members (secondary, primary and special). For non-exposed structures (except as indicated in Note 5 of 3-1-2/Table 3) and structures below the lowest ballast water line, see 3-1-2/1.3.

TABLE 3
Application of Material Classes and Grades – Structures Exposed at Low Temperatures (2017)

Structural Member Category	Material Class	
	Within 0.4L Amidships	Outside 0.4L Amidships
Secondary	I	I
Deck plating exposed to weather, in general		
Side plating above BWL		
Transverse bulkheads above BWL ⁽⁵⁾		
Primary	II	I
Strength deck plating ⁽¹⁾		
Continuous longitudinal members above strength deck, excluding longitudinal hatch coamings		
Longitudinal bulkhead above BWL ⁽⁵⁾		
Top wing tank bulkhead above BWL ⁽⁵⁾	III	II
Special		
Sheer strake at strength deck ⁽²⁾		
Stringer plate in strength deck ⁽²⁾		
Deck strake at longitudinal bulkhead ⁽³⁾		
Continuous longitudinal hatch coamings ⁽⁴⁾		

Notes:

- 1 Plating at corners of large hatch openings to be specially considered. Class III or Grade E/EH to be applied in positions where high local stresses may occur.
- 2 Not to be less than Grade E/EH within 0.4L amidships in yachts with length exceeding 250 meters (820 feet).
- 3 In yachts with breadth exceeding 70 meters (230 feet) at least three deck strakes to be Class III.
- 4 Not to be less than Grade D/DH.
- 5 (2017) Applicable to plating attached to hull envelope plating exposed to low air temperature. At least one strake is to be considered in the same way as exposed plating and the strake width is to be at least 600 mm (24 in.).

The material grade requirements for hull members of each class depending on thickness and design temperature are defined in 3-1-2/Table 4. For design temperatures $t_D < -55^\circ\text{C}$ (-67°F), materials are to be specially considered.

TABLE 4
Material Grade Requirements for Classes I, II and III at Low Temperatures (2015)

Class I

Thickness, in mm (in.)	-20 to -25°C (-4 to -13°F)	-26 to -35°C (-14 to -31°F)	-36 to -45°C (-32 to -49°F)	-46 to -55°C (-50 to -68°F)
$t \leq 10$ ($t \leq 0.39$)	A, AH	B, AH	D, DH	D, DH
$10 < t \leq 15$ ($0.39 < t \leq 0.60$)	B, AH	D, DH	D, DH	D, DH
$15 < t \leq 20$ ($0.60 < t \leq 0.79$)	B, AH	D, DH	D, DH	E, EH
$20 < t \leq 25$ ($0.79 < t \leq 0.98$)	D, DH	D, DH	D, DH	E, EH
$25 < t \leq 30$ ($0.98 < t \leq 1.18$)	D, DH	D, DH	E, EH	E, EH
$30 < t \leq 35$ ($1.18 < t \leq 1.38$)	D, DH	D, DH	E, EH	E, EH
$35 < t \leq 45$ ($1.38 < t \leq 1.80$)	D, DH	E, EH	E, EH	-, FH
$45 < t \leq 50$ ($1.80 < t \leq 1.97$)	E, EH	E, EH	-, FH	-, FH

Class II

Thickness, in mm (in.)	-20 to -25°C (-4 to -13°F)	-26 to -35°C (-14 to -31°F)	-36 to -45°C (-32 to -49°F)	-46 to -55°C (-50 to -68°F)
$t \leq 10$ ($t \leq 0.39$)	B, AH	D, DH	D, DH	E, EH
$10 < t \leq 20$ ($0.39 < t \leq 0.79$)	D, DH	D, DH	E, EH	E, EH
$20 < t \leq 30$ ($0.79 < t \leq 1.18$)	D, DH	E, EH	E, EH	-, FH
$30 < t \leq 40$ ($1.18 < t \leq 1.57$)	E, EH	E, EH	-, FH	-, FH
$40 < t \leq 45$ ($1.57 < t \leq 1.80$)	E, EH	-, FH	-, FH	-, -
$45 < t \leq 50$ ($1.80 < t \leq 1.97$)	E, EH	-, FH	-, FH	-, -

Class III

Thickness, in mm (in.)	-20 to -25°C (-4 to -13°F)	-26 to -35°C (-14 to -31°F)	-36 to -45°C (-32 to -49°F)	-46 to -55°C (-50 to -68°F)
$t \leq 10$ ($t \leq 0.39$)	D, DH	D, DH	E, EH	E, EH
$10 < t \leq 20$ ($0.39 < t \leq 0.79$)	D, DH	E, EH	E, EH	-, FH
$20 < t \leq 25$ ($0.79 < t \leq 0.98$)	E, EH	E, EH	E, FH	-, FH
$25 < t \leq 30$ ($0.98 < t \leq 1.18$)	E, EH	E, EH	-, FH	-, FH
$30 < t \leq 35$ ($1.18 < t \leq 1.38$)	E, EH	-, FH	-, FH	-, -
$35 < t \leq 40$ ($1.38 < t \leq 1.57$)	E, EH	-, FH	-, FH	-, -
$40 < t \leq 50$ ($1.57 < t \leq 1.97$)	-, FH	-, FH	-, -	-, -

Single strokes required to be of Class III or of Grade E/EH or FH are to have breadths not less than $800 + 5L$ mm, maximum 1800 mm.

Plating materials for sternframes, rudder horns, rudders and shaft brackets are not to be of lower grades than those corresponding to the material classes given in 3-1-2/1.1.

1.7 Design Temperature t_D (2017)

The design temperature t_D is to be taken as the lowest mean daily average air temperature in the area of operation.

- **Mean:** Statistical mean over observation period
- **Average:** Average during one day and night
- **Lowest:** Lowest during year

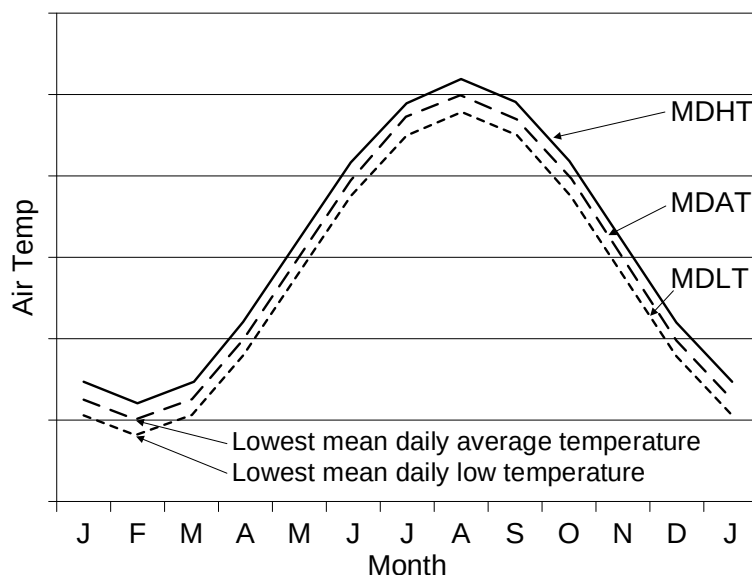
For seasonally restricted service the lowest value within the period of operation applies.

For the purpose of issuing a Polar Ship Certificate in accordance with the Polar Code, the design temperature t_D shall be no more than 13°C (23.6°F) higher than the Polar Service Temperature (PST) of the yacht.

In the Polar Regions, the statistical mean over observation period is to be determined for a period of at least 10 years.

3-1-2/Figure 1 illustrates the temperature definition.

FIGURE 1
Commonly Used Definitions of Temperatures (2017)



MDHT = Mean Daily High (or maximum) Temperature

MDAT = Mean Daily Average Temperature

MDLT = Mean Daily Low (or minimum) Temperature

3 Workmanship

All workmanship is to be of commercial marine quality and acceptable to the Surveyor. Welding is to be in accordance with the requirements of Part 2, Chapter 4 and Appendix 2-5-A1 of the *ABS Rules for Materials and Welding (Part 2)*, and Section 3-2-14 of this Guide.

5 Design

5.1 Continuity

Care is to be taken to provide structural continuity. Changes in scantlings are to be gradual, such that the minimum taper between changes is to be 3 to 1, see 3-1-2/Figure 2. Strength members are not to change direction abruptly, such that the minimum offset taper is to be 3 to 1, see 3-1-2/Figure 3. Where primary structural members terminate at another structural member, tapering of the primary member or tapering brackets may be required beyond the other structural member, as indicated in 3-1-2/Figure 4, and as required in 3-2-6/1. Stanchions and bulkheads are to be aligned to provide support and to minimize eccentric loading. Major appendages outside the hull and strength bulkheads in superstructures are to be aligned with major structural members within the hull.

FIGURE 2

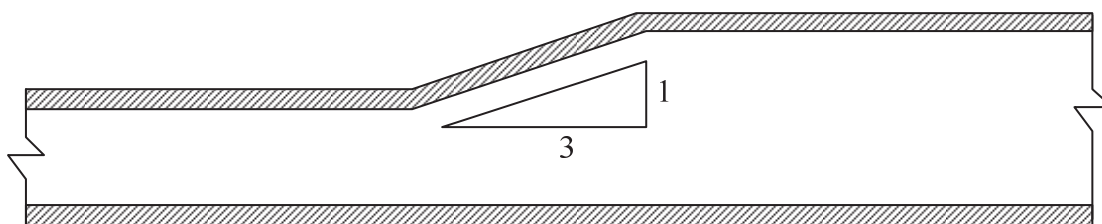


FIGURE 3

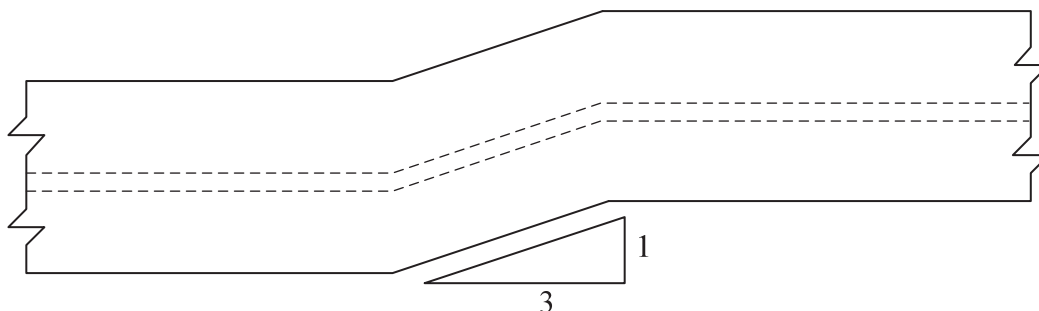
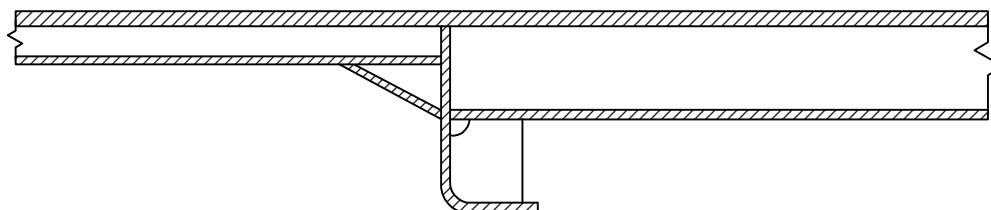


FIGURE 4



5.3 Openings

The structural arrangements and details are to be in accordance with Sections 3-2-6 and 3-2-7. In general, major openings such as doors, hatches, and large vent ducts are to be avoided in the hull in close proximity to the gunwale. Corners of openings in strength structures are to have generous radii. Compensation may be required for openings.

5.5 Brackets

5.5.1 Steel Brackets

Where brackets are fitted having thicknesses as required by 3-1-2/Table 5A and faces at approximately 45 degrees with the bulkhead deck or shell, and the bracket is supported by a bulkhead, deck or shell structural member, the length of each member, ℓ , may be measured at a point 25% of the extent of the bracket beyond the toe of the bracket as shown in 3-1-2/Figure 5. The minimum overlap of the bracket arm along the stiffener is not to be less than obtained from the following equation:

$$x = 1.4y + 30 \text{ mm} \quad x = 1.4y + 1.2 \text{ in.}$$

where

$$\begin{aligned} x &= \text{length of overlap along stiffener, in mm (in.)} \\ y &= \text{depth of stiffener, in mm (in.)} \end{aligned}$$

Where a bracket laps a member, the amount of overlap generally is to be 25.5 mm (1 in.).

5.5.2 Aluminum Brackets

Aluminum brackets are to comply with 3-1-2/5.5.1 except that the thicknesses are given in 3-1-2/Table 5B.

FIGURE 5
Bracket

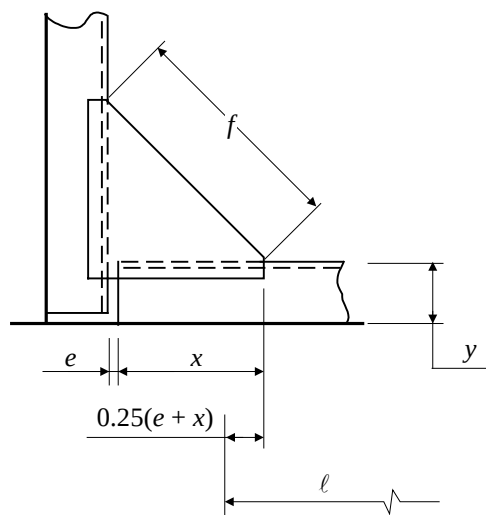


TABLE 5A
Brackets (Steel)

Thickness			
Length of Face, <i>f</i> , mm	Millimeters		Width of Flange, mm
	Plain	Flanged	
Not exceeding 305	5.0	—	—
Over 305 to 455	6.5	5.0	40
Over 455 to 660	8.0	6.5	50
Over 660 to 915	11.0	8.0	65
Over 915 to 1370	14.0	9.5	75

Thickness			
Length of Face <i>f</i> , in.	Inches		Width of Flange, in.
	Plain	Flanged	
Not exceeding 12	3/16	—	—
Over 12 to 18	1/4	3/16	1½
Over 18 to 26	5/16	1/4	2
Over 26 to 36	7/16	5/16	2½
Over 36 to 54	9/16	3/8	3

TABLE 5B
Brackets (Aluminum)

Thickness			
Length of Face, <i>f</i> , mm	Millimeters		Width of Flange, mm
	Plain	Flanged	
Not exceeding 305	7.0	—	—
Over 305 to 455	9.5	7.0	40
Over 455 to 660	11.5	9.5	50
Over 660 to 915	16.0	11.5	65
Over 915 to 1370	20.0	13.5	75

Thickness			
Length of Face <i>f</i> , in.	Inches		Width of Flange, in.
	Plain	Flanged	
Not exceeding 12	1/4	—	—
Over 12 to 18	3/8	1/4	1 1/2
Over 18 to 26	7/16	3/8	2
Over 26 to 36	5/8	7/16	2 1/2
Over 36 to 54	13/16	9/16	3

5.7 Structural Design Details

The designer is to give consideration to the following:

5.7.1

The thickness of internals in locations susceptible to rapid corrosion.

5.7.2

The proportions of built-up members to comply with established standards for buckling strength.

5.7.3

The design of structural details such as noted below, against the harmful effects of stress concentrations and notches:

- i) Details of the ends, the intersections of members and associated brackets.
- ii) Shape and location of air, drainage or lightening holes.
- iii) Shape and reinforcement of slots or cutouts for internals.
- iv) Elimination or closing of weld scallops in way of butts, "softening" of bracket toes, reducing abrupt changes of section or structural discontinuities.

5.7.4

Proportions and thickness of structural members to reduce fatigue response due to engine, propeller or wave-induced cyclic stresses, particularly for higher-strength steels.

Standard construction details based on the above considerations are to be indicated on the plans or in a booklet submitted for review and comment.

5.9 Termination of Structural Members

Unless permitted elsewhere in this Guide, structural members are to be effectively connected to the adjacent structures in such a manner to avoid hard spots, notches and other harmful stress concentrations. Where members are lightly loaded and not required to be attached at their ends, special attention is to be given to the end taper, by using brackets or by a sniped end of not more than 30°. Bracket toes or sniped ends are to be kept within 25 mm (1.0 in.) of the adjacent member and the depth at the toe or snipe end is generally not to exceed 15 mm (0.60 in.). Where a strength deck or shell longitudinal terminates without end attachment, it is to extend into the adjacent transversely framed structure or stop at a local transverse member fitted at about one transverse frame space beyond the last floor or web that supports the longitudinal.

7 Effective Width of Plating

The section modulus and moment of inertia of stiffening members are provided by the member and a portion of the plating to which it is attached. The effective width is as given in the following paragraphs. The section modulus and moment of inertia of a shape, bar, fabricated section, or laid-up member not attached to plating is that of the member only.

7.1 FRP Laminates

Where the plating is an FRP single-skin laminate, the maximum effective width of plating for floors, frames, beams and bulkhead stiffeners is not to exceed either the stiffening member spacing or the width obtained from the following equation, whichever is less. See 3-1-2/Figure 6. For sandwich laminate see 3-1-2/Figure 7.

$$w = 18t + b$$

where:

- w = effective width of plating, in mm (in.)
- t = thickness of single skin plating, in mm (in.)
- b = net width of stiffening member, in mm (in.), but not more than $18t$

Where the plating is an FRP sandwich laminate with a flexurally and compressively ineffective (balsa, cross linked PVC, or linear polymer) core, t in the above equation is the thickness of a single skin laminate having the same moment of inertia per unit width as the two skins of the sandwich about the neutral axis of the sandwich, excluding the core.

For a stiffening member along an opening, the maximum effective width of plating is equal to either one-half the stiffening member spacing or the width obtained from the following equation, whichever is less.

$$w = 9t + b$$

where w , t and b are as defined above.

FIGURE 6
Effective Width of FRP Single Skin Plating

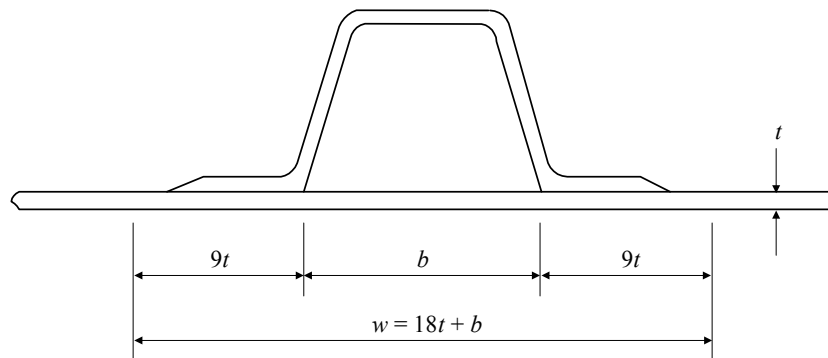
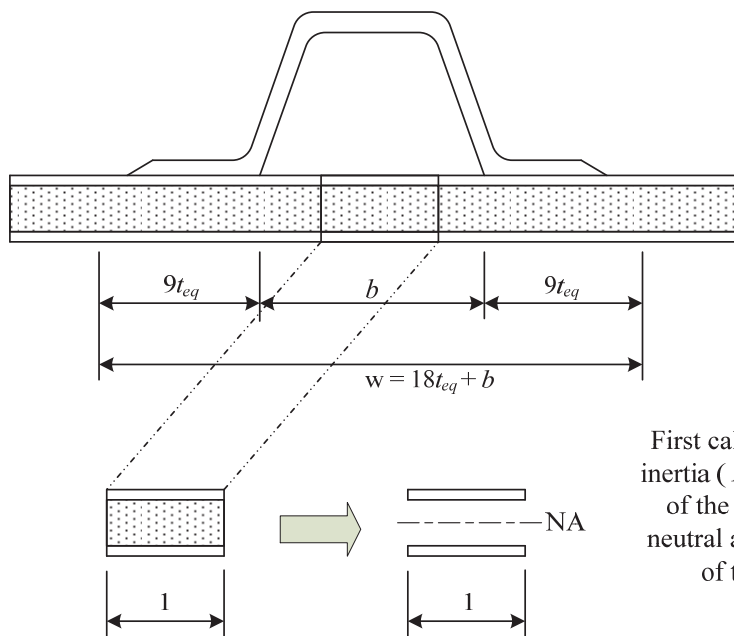


FIGURE 7
Effective Width of FRP Sandwich Plating



First calculate the moment of inertia (I_{Skins}) of one unit width of the FRP skins about the neutral axis not using the area of the core material.

The equivalent single skin thickness (t_{eq}) can then be calculated as

$$t_{eq} = \sqrt[3]{12I_{Skins}}$$

And the effective width of attached plating would be

$$w = 18t_{eq} + b$$

7.3 Steel and Aluminum Plating

7.3.1 Primary Structural Members

The effective width of plating for deep supporting members is to be equal to the lesser of either one half the sum of spacing on each side of the member, 0.33 times the unsupported span, ℓ , or 750 mm (30 in.). For girders and webs along hatch openings, the effective width of plating is to be half of that obtained from the above. Due account is to be taken in regards to plate buckling, see Appendix 3-2-A4.

7.3.2 All Other Structural Members

The maximum effective width of plating is equal to either one-half the sum of spacing on each side of the member or the width obtained from the following equation, whichever is less.

$$\text{Steel Members} \quad w = 80t$$

$$\text{Aluminum Members} \quad w = 60t$$

where

$$w = \text{effective width of plating, in mm (in.)}$$

$$t = \text{thickness of single skin plating, in mm (in.)}$$

For a stiffening member along an opening, the maximum effective width of plating is one-half of the effective width given above.

7.5 Plywood Plating

Where the plating is either plywood or an FRP sandwich laminate with a plywood core, the maximum effective width of plating is to equal either the stiffening member spacing, in millimeters (inches), or the width obtained from the following equation, whichever is less.

$$w = 50t \text{ mm (in.)}$$

where stiffening member, w and t are as defined in 3-1-2/7.1.

For a stiffening member along an opening, the maximum effective width of plating is one-half of the effective widths given above.

7.7 Wood

Where the plating is carvel construction the section modulus and moment of inertia of the stiffening member are those of the stiffening member only. Where cold-molded wood laminate is used and constructed in accordance with 3-2-7/9.3.2(a), the effective width of plating is equal to either the stiffening member spacing in millimeters or inches or the width obtained from the following equation, whichever is less.

$$w = 25t \text{ mm (in.)}$$

where stiffening member, w and t are as defined in 3-1-2/7.1.

For a stiffening member along an opening, the maximum effective width of plating is one-half of the effective widths given above.

PART

3

CHAPTER 1 General

SECTION 3 Guidance for Finite Element Analysis

1 General

The intent of this section is to provide guidance on the use of finite element methods (FEM) for evaluating linear response of hull structural components, equipment foundations and reinforcement structure to applied loads.

Finite element methods can be applied with varying level of detail and complexity to determine stress levels, deflection magnitudes and other parameters of structural components. The choice of the type of finite element and evaluation criteria should match the desired level of detail, loading scenario, boundary conditions and complexity of the structural component.

Additional fees for finite element review and approval will be charged to the owner, designer or shipyard when the review is requested.

This section is intended for yachts constructed from steel or aluminum. Yachts constructed of Fiber Reinforced Plastic (FRP) will be subject to special consideration.

3 Structural Modeling

3.1 Finite Element Types

The choice of the type of finite element is guided by the complexity of the structural system or component being analyzed, the level of detail desired and the outcomes measured. Two node line element and three or four membrane/plate element are considered sufficient for representation of a structure and requirements in this appendix assumes the use of such element types in the models. Higher order elements may also be applied. Details of basic element types are given in 3-1-3/Table 1.

TABLE 1
Finite Element Type

<i>Element Type</i>	<i>Description</i>
Rod (or truss) element	Line element with axial stiffness only and constant cross-sectional area along length of the element
Beam element	Line element with axial, torsional and bi-directional shear and bending stiffness and with constant properties along the length of the element
Membrane (or plane-stress) element	Plate element with in-plane stiffness and with constant thickness
Shell (or bending plate) element	Plate element with in-plane and out-of-plane bending stiffness and with constant thickness

3.3 Model Types

3.3.1 Beam/Grillage Model

Beam/grillage models comprise of entirely of beam and rod elements, and are suitable for the solution of simple to more elaborate beam problems of one, two or three-dimensional configuration. Examples where such models could be applied are for deck beams, girders, floors, and bulkhead stiffening. Such models provide bending moment and shear force distributions, axial, bending and shear stresses, and deflection magnitudes.

3.3.2 Plate Element Model

Plate element models are applied in cases where a precise representation of the geometry of the structural component or system is necessary, the complexity of the structure warrants it, or when the desired structural response cannot be determined from beam or grillage models.

3.5 Modeling Guidance

- i) The model should include, as applicable, all primary load-carrying members of the structure being analyzed. Secondary structural members that may significantly affect load distributions and local response of the primary members may also be appropriately included in the model.
- ii) For beam elements, cross sectional properties are to be based on that of effective width of the attached plating. The effective width of plating of beam elements is not to exceed the sum of one-half of the spacing on either side of the structural member or $\frac{1}{3}$ of the unsupported span of the member, whichever is less.
- iii) Plate element meshing is to follow the stiffening system as far as practicable. The mesh size used should be adequate to represent the overall stiffness of the considered structure. For meshing of large systems such as deck, shell or bulkhead plate/framing systems, the mesh size is to not exceed the spacing between the frames. The mesh should be progressively and smoothly refined to capture structural details where important or found necessary.
- iv) At least three elements are to be used, where practical, to model webs of primary supporting members such as girders, transverses, stringers and floors. Rod elements may be used to model flanges of primary supporting members and brackets. The cross sectional area of rods representing sniped or tapered flanges is to be considered proportionally using an average area over the length of the element.
- v) The aspect ratio of plate elements, in general, is not to exceed three. The use of triangular plate elements is to be kept to a minimum.
- vi) Shell elements are to be used for plate elements subjected to lateral loading.

3.7 Boundary Conditions

Boundary conditions applied are to reflect, as closely as possible, the actual support conditions of the structure.

The extent of model should be sufficient to establish proper boundary conditions. Where the model has been extended to points well away from the areas of interest within the model, boundary conditions may be reasonably simplified, for example assuming fully fixed conditions for plate elements models.

3.9 Loads

Loads applied on a model are to be as required by the relevant rule or the design loads of the structural member, whichever is greater.

In addition to static loads, other loads such as hull girder and dynamic loads arising out of acceleration, ship motion, etc. are to be considered where applicable and relevant.

In typical cases, it is not necessary to consider the self-weight of the structure, unless it is expected to be a significant component of the loads acting on the structure.

Loads are to be applied in a manner so as to match, as closely as possible, the expected distribution and manifestation of the load within the structure in the actual situation.

The stress criteria of 3-1-3/3.11 are related to the ABS Rule loads. Where the designer uses loading other than the rules such model testing or numerical simulation the safety factors will be specially considered taking into account a safety factor the equates to an equivalent level of lifetime exceedance as provided by the Rule loads.

3.11 Stress Criteria

Unless otherwise specified in this Guide or relevant regulations, individual stress components and, as applicable, direct combinations of such stresses in beam or grillage models are not to exceed the allowable stress F .

$$F = F_y/FS$$

where

F_y = specified minimum yield strength of the material, for aluminum F_y is to be in the as-welded condition.

FS = Factor of Safety

For static loadings:

= 1.67 for axial or bending stress

= 2.50 for shear stress

For loads combining static and dynamic:

= 1.25 for axial or bending stress

= 1.88 for shear stress

For plate element models, and unless otherwise specified in this Guide or relevant regulations, the Von-Mises equivalent stress is not to exceed the limits specified in 3-1-3/Table 2 for steel and 3-1-3/Table 3 for aluminum based on the specific mesh size. Component stresses (σ_x , σ_y , τ_{xy}) are to be less than or equal to allowable local structure design stress. Stress criteria for FRP will be subject to special consideration.

TABLE 2
Steel Stress Limits for Plate Element Models

Mesh Size	Stress Limit
1 × stiffener spacing (SS)	0.90 $S_m F_y$
$\frac{1}{2} \times SS$	0.95 $S_m F_y$
$\frac{1}{3} \times SS$	1.00 $S_m F_y$
$\frac{1}{4} \times SS$ ⁽¹⁾	1.06 $S_m F_y$
$\frac{1}{5} \times SS \sim \frac{1}{10} \times SS$ ⁽¹⁾	1.12 $S_m F_y$

Notes:

- 1 Stress limits greater than 1.00 $S_m F_y$ are to be restricted to small areas in way of structural discontinuities.
- 2 S_m = 1.0 for mild steel
= 0.95 for HT 32
= 0.908 for HT 36
- 3 For intermediate mesh size, the stress limit may be obtained by linear interpretation
- 4 For longitudinally effective structure that is modeled without the hull girder loads, the allowable stresses are to be decreased by 10%

TABLE 3
Aluminum Stress Limits for Plate Element Models

Mesh Size	Stress Limit
1 × stiffener spacing (SS)	0.80 F_y
$\frac{1}{2} \times SS$	0.85 F_y
$\frac{1}{3} \times SS$	0.90 F_y
$\frac{1}{4} \times SS$ ⁽¹⁾	0.95 F_y
$\frac{1}{5} \times SS \sim \frac{1}{10} \times SS$ ⁽¹⁾	1.00 F_y

Notes:

- 1 For intermediate mesh size, the stress limit may be obtained by linear interpretation
- 2 For longitudinally effective structure that is modeled without the hull girder loads, the allowable stresses are to be decreased by 10%