



RULES FOR BUILDING AND CLASSING

STEEL BARGES 2018

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

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RULES FOR BUILDING AND CLASSING STEEL BARGES

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Introduction

1. The year 2018 edition of the *Rules for Building and Classing Steel Barges* consists of the eight (8) 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 vessels, barges and specific shipboard arrangements/systems, etc., except for those in offshore service, as specified in the Foreword to Part 1. Additional specific requirements are contained in Part 1 of these *Rules for Building and Classing Steel Barges*.
 - 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 primary changes from the 2017 edition of the Rules are identified and listed in Table 3. The effective date of the indicated Rule Changes is 1 January 2018, unless specifically indicated otherwise.
4. 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
5. Until the next edition of the *Rules for Building and Classing Steel Barges* is published, 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 Notices and/or Corrigenda to existing Rules or Guides. The consolidated edition of the *Rules for Building and Classing Steel Barges*, which includes Notices and/or Corrigenda using different colors for easy recognition, will be published on the ABS website only when Notices and/or Corrigenda are issued.
6. 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 Barge Rules

Rules for Building and Classing Steel Barges		
Notices and General Information		2018
Part 1:	Conditions of Classification (Supplement to the ABS <i>Rules for Conditions of Classification</i>) ⁽¹⁾	2018
Part 3:	Hull Construction and Equipment	2018
Part 4:	Barge Systems and Machinery	2018
Part 5:	Specific Barge Types	2018
Rules for Conditions of Classification – not included ^(1,2)		
Part 1:	Rules for Conditions of Classification	2018
Rules for Materials and Welding – not included ⁽²⁾		
Part 2:	Rules for Materials and Welding	2018
Rules for Survey After Construction – not included ⁽²⁾		
Part 7:	Surveys After Construction	2018

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

<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. 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.

Rule Change Notice (2018)

TABLE 3
Summary of Changes from the 2017 Rules

Notice No. 1 (effective on 1 July 2017) to the 2017 Rules, which is incorporated into the 2018 Rules, is summarized below.

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 5	Specific Barge Types	
5-2-3/1.11	Deck Cargo	To permit necessary trade to remotely located geographic locations. (Incorporates Notice No. 1)
5-3-3/5.7.3	Acceptable Stresses	To align allowable stresses with the <i>ABS Guide for Certification of Lifting Appliances</i> as well as the <i>ABS Rules for Building and Classing Offshore Support Vessels</i> . (Incorporates Notice No. 1)
5-3-4/5.5.3	Allowable Stresses	To align allowable stresses with the <i>ABS Guide for Certification of Lifting Appliances</i> as well as the <i>ABS Rules for Building and Classing Offshore Support Vessels</i> . (Incorporates Notice No. 1)

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	
3-2-4/3.1	Channel Construction	To specify that floating corners are not allowed in the construction of ocean barges.
3-2-4/Figure 2A (New)	Side Channels Attached to Deck and Bottom Plating	To specify that floating corners are not allowed in the construction of ocean barges.
3-2-4/Figure 2B (New)	Side Channels Attached to Deck and Bottom Plating	To specify that floating corners are not allowed in the construction of ocean barges.
3-2-4/3.11	Minimum Thicknesses	To limit the maximum required thickness for girders and webs, in line with other ABS Rules.
3-2-5/3.15.2	Stanchions	To modify the permissible load to consider material yield strength.
3-2-7/3.5.3	Proportions	To limit the maximum required thickness for girders and webs, in line with other ABS Rules.
3-2-11/5.9 (New)	Bolted Connections	To specify requirements for bolted connections on helidecks.
3-2-11/7.7	Means of Escape and Access	To clarify the requirements for aluminum helideck escape stairs and intermediate platforms.
3-4-1	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 4	Barge Systems and Machinery	
4-1-1/1.1	Machinery and Equipment	To clarify ABS minimum requirements for diesel engines having a rated power of 100 kW (135 hp) and over, intended for services considered not essential for propulsion, maneuvering and safety.

Notices and General Information

<i>Part/Para. No.</i>	<i>Title/Subject</i>	<i>Status/Remarks</i>
PART 5	Specific Barge Types	
5-1-1/15.3	Stanchions	To modify the permissible load to consider material yield strength.
5-2-1/1.3	Scantlings	To include requirements for the employment of independent tanks for carrying cargo temperature above 200°C and guidance regarding the construction of FEA models and acceptance criteria.
5-2-2/1.3	Scantlings	To include requirements for the employment of independent tanks for carrying cargo temperature above 200°C and guidance regarding the construction of FEA models and acceptance criteria.
5-2-3/1.3	Scantlings	To include requirements for the employment of independent tanks for carrying cargo temperature above 200°C and guidance regarding the construction of FEA models and acceptance criteria.
5-2-4/1.3	Scantlings	To include requirements for the employment of independent tanks for carrying cargo temperature above 200°C and guidance regarding the construction of FEA models and acceptance criteria.
5-3-1/9.3	Barge Hull Structure	To clarify that a barge may be assigned the SC, SHCM Notation.

PART

1

Conditions of Classification
(Supplement to the ABS Rules for Conditions of Classification)

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PART

1

Foreword (1 January 2008)

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 this 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 steel barges. This supplement is always to be used with the aforementioned *Rules for Conditions of Classification (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 (*1 January 2008*)

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

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

PART

1

CHAPTER 1 Scope and Conditions of Classification

SECTION 2 Classification Symbols and Notations (1 January 2008)

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 steel barges.

1 Unrestricted Service

Barges which have been built to the satisfaction of the ABS Surveyors to the full requirements of the Rules, or to their equivalent, where approved by the Committee for unrestricted ocean service will be classed and distinguished in the *Record* by the symbols **✕ A1** followed by the appropriate designation, such as **Oil Tank Barge**, **Fuel Oil Tank Barge**, etc., indicating compliance with the requirements of the Rules.

3 Classification Designations (2015)

3.1 Barge

For all barges not falling under the categories of 1-1-2/5.1 through 1-1-2/5.33 of this Supplement to the *ABS Rules for Conditions of Classification (Part 1)*, a note will be included in the *Record* describing the primary function of the barge such as deck cargo barge, bulk cargo barge, etc. Design review and survey are to be carried out in accordance with the applicable Rule requirements for the intended service and primary function of the barge and Classed as such.

5 Notations (2015)

5.1 Oil Tank Barge

Barge intended to carry petroleum products with a flash point at or below 60°C (140°F) (closed cup test).

5.3 Fuel Oil Tank Barge

Barge intended to carry petroleum products with a flash point above 60°C (140°F) (closed cup test).

5.5 Chemical Tank Barge

Barge intended to carry dangerous chemicals, such as those indicated in 5-2-4/1.9.

5.7 Liquefied Gas Tank Barge (2015)

Barge intended to carry liquid gases such as those indicated in Section 5-2-5.

5.9 Tank Barge

Barge intended to carry liquids in bulk not covered by other classification designations of this Part.

5.11 Independent Tank Barge

Barge intended to carry cargo in independent tanks with a working pressure below 2.06 bar (2.1 kgf/cm², 30 psi) and not covered by other classification designations of this Part.

5.13 Pressure Tank Barge

Barge intended to carry cargo in independent tanks with a working pressure at 2.06 bar (2.1 kgf/cm², 30 psi) or above and not covered by other classification designations of this part.

5.15 Fuel Oil or Chemical Tank Barge

Barge intended to carry petroleum products or dangerous chemicals, but not at the same time, as stated in 1-1-2/5.3 and 1-1-2/5.5 of this Supplement to the *ABS Rules for Conditions of Classification (Part 1)*.

5.17 Fuel Oil and Chemical Tank Barge

Barge intended to carry petroleum products and dangerous chemicals, at the same time, as stated in 1-1-2/5.3 and 1-1-2/5.5 of this Supplement to the *ABS Rules for Conditions of Classification (Part 1)*.

5.19 Oil or Chemical Tank Barge

Barge intended to carry petroleum products or dangerous chemicals, but not at the same time, as stated in 1-1-2/5.1 and 1-1-2/5.5 of this Supplement to the *ABS Rules for Conditions of Classification (Part 1)*.

5.21 Oil and Chemical Tank Barge

Barge intended to carry petroleum products and dangerous chemicals, at the same time, as stated in 1-1-2/5.1 and 1-1-2/5.5 of this Supplement to the *ABS Rules for Conditions of Classification (Part 1)*.

5.23 ITB Barge (2015)

The notation **ITB** is intended for a tug-barge combination wherein a tug is mated to a barge with an especially designed connection system such that the tug is secured in the barge notch or on fenders by mechanical means of any type whatsoever other than simply wire ropes, chains, lines or other tackle. See Section 5-3-1.

5.25 Oil Spill Recovery Barges (OSR-S1, OSR-C1, OSR-S2 or OSR-C2) (2015)

Barges intended to recover spilled oil from the sea. The notations **OSR-S1**, **OSR-C1**, **OSR-S2** or **OSR-C2** will be assigned based on barge type as indicated in 5-3-2/1.3. See Section 5-3-2.

5.27 Crane CRC Barge (2015)

The notation **Crane CRC** is intended for barges fitted with cranes permanently installed on board the barge and intended for operations other than supply of provisions and maintenance of the barge. They can be pedestal mounted rotating, heavy lift, gantry, shear leg, stiffleg and "A"-frame type cranes, as defined in 2-1/9.1, 2-1/9.3 and 2-1/9.5 of the *ABS Guide for Certification of Lifting Appliances*. Other types of cranes will be considered on an individual basis. See Section 5-3-3.

5.29 Pipe Laying Barge (2015)

The notation **Pipe Laying** is intended apply to barges intended for unrestricted service that are primarily engaged in installation of subsea pipelines. See Section 5-3-4.

5.31 Cable Laying Barge (2015)

The notation **Cable Laying** is intended apply to barges intended for unrestricted service that are primarily engaged in installation, maintenance and repair of underwater telecommunication cables and power transmission cables. See Section 5-3-5.

5.33 Accommodation Barge (2015)

The notation **Accommodation** is intended for barges which operate offshore as accommodation barges or other barge types that are provided with accommodations in support of the workings of the barge. See Section 5-3-6.

5.35 Machinery

Machinery and systems for barges are to comply with the applicable requirements of Part 4 of the *ABS Rules for Building and Classing Steel Barges*. Thruster machinery and systems used for short field moves (consisting of moving the unit from one work location to another location within the same area of operation, that takes no longer than 12 hours and is conducted in daylight hours) of non-propelled units and complying with the requirements of the *Steel Vessel Rules* as applied to self-propelled units, manufactured and installed under ABS survey and found satisfactory after trials, will be distinguished in the *Record* by the notation **⊠ AMS-NP**, as appropriate.

7 Dual and Multi-Purpose Barges (2015)

Barges intended for several functional services covered by Part 5 of these Rules may be assigned a combination of the class notations provided that the specific requirements for each intended service are complied with.

For example, a barge capable of lifting operations and having accommodations on board could be assigned the classification **⊠ A1 Barge, Crane CRC, Accommodation**.

PART

1

CHAPTER 1 Scope and Conditions of Classification

SECTION 3 Rules for Classification (*1 January 2008*)

1 Application

1.1 General

These Rules are applicable to steel barges intended for unrestricted ocean service, except where specifically mentioned otherwise.

1.3 Safety Requirements for Barges with Personnel

Barges which are intended to be manned at sea, whether on a voyage or on-site offshore by crew or special personnel, are to comply with Section 3-5-1 of these Rules. Special personnel are persons who are not passengers or crew and who are carried on board in connection with the special purpose of that barge or because of the special work being carried out aboard that barge.

3 Interpretation

Any disagreement regarding either the proper interpretation of the Rules or translation of the Rules from the English language edition is to be referred to ABS for resolution.

PART

1

CHAPTER 1 Scope and Conditions of Classification

SECTION 4 Submission of Plans

1 Hull Plans (2011)

Plans showing the scantlings, arrangements, and details of the principal parts of the hull structure of each barge to be built under survey are to be submitted and approved before the work of construction is commenced. These plans are to indicate clearly the scantlings and details of welding, and they are to include such particulars as the design draft. Where provision is to be made for any special type of cargo or for any exceptional conditions of loading, whether in ballast or with cargo, particulars of the weights to be carried and of their distribution are also to be given.

In general these plans should include the following:

- General Arrangement (for information)
- Midship Section
- Scantling Profile and Decks
- Bottom construction, floors, girders, etc.
- Framing Plan
- Inner Bottom Plating
- Shell Expansion
- Deck Plans
- Trusses
- Pillars and Girders
- Watertight and Deep-tank Bulkheads
- Miscellaneous Non-tight Bulkheads which are used as structural supports
- Skeg attachment foundations
- Bow framing
- Stern framing
- Superstructures and Deckhouses and their closing arrangements
- Hatches and Hatch-closing Arrangements
- Ventilation system on weather decks
- Anchor handling arrangements

Plans should generally be submitted electronically to ABS. However, hard copies will also be accepted.

3 Loading Conditions

The Rules are published with the understanding that responsibility for stability and trim, for handling and loading, as well as for avoidance of distributions of weight which are likely to set up abnormally severe stresses in barges does not rest upon the Committee. Where it is desired to provide for exceptional conditions of loading, full particulars are to be given in connection with the submission of plans as outlined in 1-1-4/1 of this Supplement to the *ABS Rules for Conditions of Classification (Part 1)*.

5 Machinery Plans (2011)

Plans showing the proposed arrangements of bilge, ballast, cargo, electrical, vents and sounding systems, associated pumping machinery and other machinery, equipment and systems as referenced in Sections 4-1-1, 4-1-2 and 4-1-3 are to be submitted and approved before proceeding with the work. The sizes, materials, joint details and welding or other methods of construction are to be shown on the plans as clearly and fully as possible. Plans and data, as applicable, should generally be submitted electronically to ABS. However, hard copies will also be accepted. All plan submittals originating from manufacturers are understood to be made with the cognizance of the shipbuilder.

Materials and Welding

The independent booklet, *ABS Rules for Materials and Welding (Part 2)*, for steels, irons, bronzes, etc., is to be referred to. This booklet consists of the following Chapters:

Rules for Testing and Certification of Materials

CHAPTER 1 Materials for Hull Construction

CHAPTER 2 Equipment

CHAPTER 3 Materials for Machinery, Boilers, Pressure Vessels, and Piping

APPENDIX 1 List of Destructive and Nondestructive Tests Required for Materials and Responsibility for Verifying

APPENDIX 4 Procedure for the Approval of Manufacturers of Hull Structural Steel

APPENDIX 5 Procedure for the Approval of Manufacturers of Hull Structural Steels Intended for Welding with High Heat Input

APPENDIX 6 Nondestructive Examination of Marine Steel Castings

APPENDIX 7 Nondestructive Examination of Hull and Machinery Steel Forgings

APPENDIX 8 Additional Approval Procedure for Steel with Enhanced Corrosion Resistance Properties

Rules for Welding and Fabrication

CHAPTER 4 Welding and Fabrication

APPENDIX 2 Requirements for the Approval of Filler Metals

APPENDIX 3 Application of Filler Metals to ABS Steels

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Hull Construction and Equipment

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PART

3

CHAPTER 1 General

SECTION 1 Definitions

1 Application

The following definitions of symbols and terms are to be understood (in the absence of other specifications) where they appear in the Rules.

3 Length

The length, L , shall be taken as 96 percent of the total length, in meters (feet), on a waterline at 85 percent of the least molded depth, D . In barges designed with a rake of keel, the waterline on which this length is measured shall be parallel to the designed waterline.

5 Breadth

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

7 Depth

The depth, D , is the molded depth, in meters (feet), measured at amidships from the molded baseline to the molded line of the strength deck plating at the side of the barge.

9 Molded Baseline

The *Molded Baseline* is a horizontal line extending through the upper surface of the bottom shell plating at the centerline, amidships.

11 Draft

The draft, d , is the molded draft, in meters (feet), from the molded baseline to the summer load line.

13 Freeboard Deck

The *Freeboard Deck* is normally the uppermost deck having permanent means for closing all openings.

15 Forecastle Deck

The *Forecastle Deck* is the deck above the freeboard deck forward to which the side shell plating extends.

17 Truss (2017)

A *Truss* is a system of internal framing members comprised of top and bottom chords extending either fore and aft or athwartships in association with regularly spaced stanchions and diagonals. The spacing of the stanchions generally is not to exceed the depth of the truss so that the diagonal members will not have angles of inclination with the horizontal less than approximately 45°. A single-laced truss is one having diagonal bracing in only one direction in each space between stanchions; a double-laced truss is one having diagonal bracing in both directions in each space. See 5-1-1/Figures 1 through 3.

19 Side Shell Plating Amidships

The term *Side Shell Plating Amidships* refers to the plating of the side shell from the upper turn of the bilge to the deck at the side between 0.2L forward and 0.2L aft of amidships.

21 Bottom Shell Plating Amidships

The term *Bottom Shell Plating Amidships* refers to the plating of the bottom shell from the keel to the upper turn of the bilge between 0.2L forward and 0.2L aft of amidships.

23 Tonne

The term *Tonne (t)*, as contained within the Rules, refers to a metric ton of one thousand kilograms.

25 Ton

The term *Ton (Lt)*, as contained within these Rules, refers to a long ton of 2240 lbs.

27 Perpendiculars

The *Forward and After Perpendiculars* shall be taken at the forward and after ends of the length, *L*. The forward perpendicular shall coincide with the foreside of the stem on the waterline on which the length, *L*, is measured. (See 3-1-1/39).

29 Amidships

Amidships is the middle of the length, *L*.

31 Block Coefficient (C_b)

The *Block Coefficient* (C_b), is given by

$$C_b = \nabla / LBd$$

where ∇ is the volume of molded displacement, excluding appendages, in cubic meters (cubic feet).

33 Bottom Forward Plating

- i) In rake end barges, the *Bottom Forward Plating* is the bottom plating of the forward rake from the forward headlog to the lower turn of the rake or to the collision bulkhead, if located aft of the lower turn of the rake.
- ii) In ship-shape bow barges, the *Bottom Forward Plating* is the flat of bottom plating forward of 0.3L from amidships.

35 Yield Point

The *Yield Point* is the first stress in a material, less than the maximum obtainable stress, at which an increase in strain occurs without an increase in stress. Yield point may be determined by the halt of the pointer or autographic diagram. The 0.5% total extension under load method will also be considered acceptable.

37 Yield Strength

The *Yield Strength* is the stress at which a material exhibits a specified limiting deviation from the proportionality of stress to strain. Yield strength is to be determined by the 0.2% offset method. Alternatively, for material whose stress-strain characteristics are well known from previous tests in which stress-strain diagrams were plotted, the 0.5% extension under load method may be used.

39 Double Ended Rake Barge

A *Double Ended Rake Barge* is a barge with similar rakes at each end and fitted with towing bitts arranged in such a manner that the barge in normal circumstances may be towed from either end. Each end of barges with this configuration is to be considered as the forward end in the application of these Rules.

41 Oil

As used in these Rules, the term *Oil* refers to petroleum products having flash points at or below 60°C (140°F), (closed cup test).

43 Superstructure

A *Superstructure* is a decked structure on the freeboard deck extending from side to side of the barge or with the side plating not being inboard of the shell plating more than 0.04B.

45 Deadweight

The term *Deadweight (Dwt)*, as used in these Rules, means the difference, in tonnes (tons), between the displacement of a barge in water of specific gravity 1.025 at the assigned summer load line and the lightweight of the barge.

47 Cargo Area

The *Cargo Area* is that part of a barge that contains cargo tanks, slop tanks and cargo pump rooms and includes ballast and void spaces, cofferdams and pump rooms adjacent to cargo tanks and also deck areas throughout the entire length and breadth of that part of the barge over the above mentioned spaces. In chemical tank barges having independent cargo tanks installed in hold spaces, cofferdams or ballast or void spaces aft of the after most hold space bulkhead or forward of the forward-most hold space bulkhead are excluded from the cargo area.

49 Cargo Pump Room

A *Cargo Pump Room* is a space containing pumps and their accessories for the handling of the cargo.

51 Control Stations

Control Stations are those spaces in which the barge's radio or emergency source of power is located or where the fire recording or fire control equipment is centralized, but does not include special fire control equipment which can be most practically located in the cargo area.

53 Machinery Spaces

Machinery Spaces are those spaces and trunks to such spaces which contain propelling machinery (such as for a bow thruster), boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling station, refrigerating, stabilizing, ventilation and air-conditioning machinery, and similar spaces.

55 Pump Rooms

Pump Rooms are spaces, located in the cargo area, containing pumps and their accessories for the handling of ballast or fuel oil.

57 Service Spaces

Service Spaces are those spaces used for galleys, pantries containing cooking appliances, lockers, mail and specie rooms, storerooms, workshops other than those forming part of the machinery spaces and similar spaces and trunks to such spaces.

59 Units

These Rules are written in three systems of units, i.e., 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 the Rules 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 and Fabrication

1.1 Materials

1.1.1 Steel

These Rules are intended for barges of welded construction using steels complying with the requirements of Chapters 1 and 2 of the *ABS Rules for Materials and Welding (Part 2)*. Use of steels other than those in Chapters 1 and 2 of the above Part 2 and the corresponding scantlings will be specially considered.

1.1.2 Aluminum Alloys

The use of aluminum alloys in hull structures will be considered upon submission of the proposed specification for the alloy and the method of fabrication.

1.1.3 Design Consideration

Where scantlings are reduced in connection with the use of higher-strength steel or where aluminum alloys are used, adequate buckling strength is to be provided. Where it is intended to use material of cold flanging quality for important longitudinal strength members, this steel is to be indicated on the plans.

1.1.4 Guidance for Repair

Where a special welding procedure is required for the special steels used in the construction, including any low temperature steel and those materials not in Chapters 1 and 2 of the *ABS Rules for Materials and Welding (Part 2)*, a set of plans showing the following information for each steel should be placed aboard the barge.

- Material Specification
- Welding procedure
- Location and extent of application

These plans are in addition to those normally placed aboard which are to show all material applications.

3 Application of Steel Materials 100 mm (4.0 in.) and Under in Thickness (2014)

Steel materials are to be of the grade required by 3-1-2/Table 2 for the material class given in 3-1-2/Table 1 for the particular location.

TABLE 1
Material Class of Structural Members

Structural Member	Material Class ⁽¹⁾	
	Within 0.4L Amidships	Outside 0.4L Amidships
Shell		
Bottom Plating including keel plate	III	I
Bilge strake	IV ^(2,3,4)	III ^(5,6)
Side plating	II	I
Sheer strake at strength deck ⁽⁷⁾	IV ^(3,4,8)	III ^(5,6)
Decks		
Strength deck plating ⁽⁹⁾	III	I
Stringer plate in strength deck ⁽⁷⁾	IV ^(3,4,8)	III ^(5,6)
Strength deck plating within line of hatches and exposed to weather, in general	II	I
Strength deck strake on tank barges at longitudinal bulkhead ⁽¹⁰⁾	IV ^(3,4)	III ^(5,6)
Longitudinal Bulkheads		
Lowest strake in single bottom barges	II	I
Uppermost strake including that of the top wing tank	III	I
Other Structures in General		
Continuous longitudinal members above strength deck	III	I
Strength members not referred to in above categories and local structures	I	I

Notes:

- Special consideration will be given to barges in restricted service.
- May be of class III in barges with a double bottom over the full breadth and with a length, *L*, less than 150 m (492 ft).
- Single strakes required to be of material class IV and V grade or grade E are to have breadths not less than $800 + 5L$ mm ($31.5 + 0.06L$ in.), but need not exceed 1800 mm (71 in.).
- Below 90 m (295 ft) in length, *L*, this may be class III.
- May be class II outside 0.6L amidships.
- Below 90 m (295 ft) in length, *L*, this may be class I.
- 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 3-1-2/5.
- To be class V in barges with length, *L*, exceeding 250 m (820 ft).
- Plating at the corners of large hatch openings are to be specially considered.
- For tank barges having a breadth exceeding 70 m (230 ft) at least the centerline strake and one strake port and starboard at the longitudinal bulkheads are to be class IV.

TABLE 2
Material Grade (2017)

Grade CS may be used in place of Grade E.

Grade DS may be used in place of Grade D.

Plate Thickness, t , mm (in.)	Material Class				
	I	II	III	IV	V
$t < 15$ ($t < 0.60$)	A ⁽²⁾ ,AH	A,AH	A,AH	A,AH	D,DH
$15 < t \leq 20$ ($0.60 < t \leq 0.79$)	A,AH	A,AH	A,AH	B,AH	D1,DH
$20 < t \leq 25$ ($0.79 < t \leq 0.98$)	A,AH	A,AH	B,AH	D,DH	E,EH
$25 < t \leq 30$ ($0.98 < t \leq 1.18$)	A,AH	A,AH	D,DH	D ⁽¹⁾ ,DH	E,EH
$30 < t \leq 35$ ($1.18 < t \leq 1.38$)	A,AH	B,AH	D,DH	E,EH	E,EH
$35 < t \leq 40$ ($1.38 < t \leq 1.57$)	A,AH	B,AH	D,DH	E,EH	E,EH
$40 < t \leq 100$ ($1.57 < t \leq 4.0$)	B,AH	D,DH	E,EH	E,EH	E,EH

Note:

- Grade D and DS of these plate thicknesses to be normalized.
- (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.

5 Forming

Steel is not to be formed between the upper and lower critical temperatures. Forming in the range between 205°C (400°F) and 425°C (800°F) should be avoided. If the forming temperature exceeds 650°C (1200°F) for as-rolled, controlled rolled, thermo-mechanical controlled rolled or normalized steels, or is not at least 28°C (50°F) lower than the tempering temperature for quenched and tempered steels, mechanical tests are to be performed to assure that these temperatures have not adversely affected the mechanical properties of the steel.

For applications where toughness is of particular concern (such as Class IV or Class V of 3-1-2/Table 1, when steel is formed below 650°C (1200°F) beyond 3% strain on the outer fiber calculated on the basis of:

$$\% \text{ strain} = \frac{65 \times \text{plate thickness}}{\text{outer radius}}$$

supporting data is to be provided to the satisfaction of the Surveyor indicating that the impact properties meet minimum requirements after forming. After straining, specimens used in Charpy impact tests are to be subjected to an artificial aging treatment of 288°C (550°F) for 1 hour before testing. Rule steels or equivalent steels used for bilge strakes or radius gunwales (in accordance with 3-1-2/Table 1) may be cold formed without requiring stress relieving or other supporting data. For barges of 90 m (295 ft) or more in length, the radius is to be at least 15t.

7 Scantlings (2015)

7.1 General

The amidships scantlings as specified in the Rules are to apply throughout the midship 0.4L. End scantlings are not to extend for more than 0.1L from each end of the barge. The reduction from the midship to the end scantlings is to be effected in as gradual a manner as practicable. Sections having appropriate section moduli or areas, in accordance with their functions in the structure as stiffeners, columns or combinations of both, are to be adopted, due regard being given to the thickness of all parts of the sections to provide a proper margin for corrosion. It may be required that calculations be submitted in support of resistance to buckling for any part of the barge's structure.

9 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 Section 3-2-12. The Surveyors are to satisfy themselves that all operators to be employed in the construction of barges to be classed are properly qualified in the type of work proposed and in the proper use of the welding processes and procedures to be followed.

11 Drydocking

For barges 225 m (738 ft) and over in length, information indicating docking arrangements is to be prepared and furnished for guidance.

13 Structural Sections

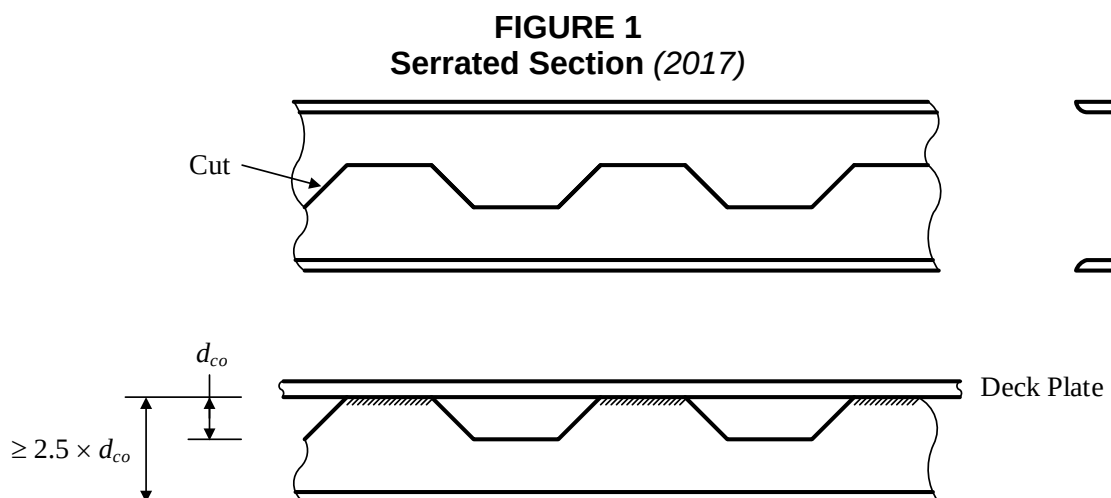
13.1 Required Section Modulus

The scantling requirements of these Rules are applicable to structural angles, channels, bars, and rolled or built-up sections. The required section modulus of members such as girders, webs, etc., supporting frames and stiffeners is to be obtained with an effective width of plating basis as described below, unless otherwise noted. The section modulus is to include the structural member in association with an effective width of plating equal to one-half the sum of the spacing on each side of the member or 33% of the unsupported span, ℓ , whichever is less. For girders and webs along hatch openings, an effective breadth of plating equal to one-half the spacing or 16.5% of the unsupported span, ℓ , whichever is less, is to be used. Where channel construction is adopted, as permitted by 3-2-4/3.1 and as illustrated in 5-1-1/Figure 1 and 5-2-1/Figure 1, the required section modulus is to be obtained solely by the channel.

The required section modulus of frames and stiffeners is assumed to be provided by the stiffener and one frame space of the plating to which it is attached.

13.3 Serrated Sections (2017)

Serrated sections may be used for girders, webs, frames and stiffeners, but the depth of the member is not to be less than 2.5 times the depth of any cutout. The cutouts are to be arranged to provide regularly spaced points of contact with the plating sufficient to obtain the welding required. See 3-1-2/Figure 1 below:



13.5 Frames, Beams and Stiffeners (2016)

13.5.1 Section Modulus

The required section modulus is assumed to be provided by the stiffener and a maximum of one frame space of the plating to which it is attached.

13.5.2 Web Thickness

The ratio of depth to thickness of the web portion of members is not to exceed the following:

Members with flange $50C_1C_2$

Members without flange $15C_1C_2$

where

$C_1 = 0.95$ (horizontal web within tank)

$= 1.0$ (all other cases)

$C_2 = 1.0$ (ordinary strength steel)

$= 0.92$ (HT32)

$= 0.90$ (HT36)

15 Structural Design Details

15.1 General

The designer shall give consideration to the following:

15.1.1

The thickness of internals in locations susceptible to rapid corrosion.

15.1.2 (2016)

The proportions of built-up members to comply with established standards for buckling strength. Also see 3-1-2/13.5.

15.1.3

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 cut-outs 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.

15.1.4

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

15.3 Termination of Structural Members (2015)

Unless permitted elsewhere in the Rules, structural members are to be effectively connected to the adjacent structures in such a manner as to avoid hard spots, notches and other harmful stress concentrations. Where members are not required to be attached at their ends, special attention is to be given to the end taper, by using soft-toed concave brackets or by a sniped end of not more than 30°. Where the end bracket has a face bar, it is to be sniped and tapered 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. Longitudinals, where allowed to terminate on either side of transverse bulkheads per 3-2-4/3.3, are to end not more than 50.8 mm (2.0 in.) from the bulkhead plating.

17 Tanks Forward of the Collision Bulkhead

Tanks forward of the collision bulkhead are not to be arranged for the carriage of oil or other liquid substances that are flammable.

19 Water Ballast Spaces (2011)

Any compartment designated for salt water ballast is to have a corrosion resistant hard type coating such as epoxy or zinc on all internal surfaces. Where a long retention of salt water ballast is expected due to the type of barge, special consideration for the use of inhibitors or sacrificial anodes may be given.

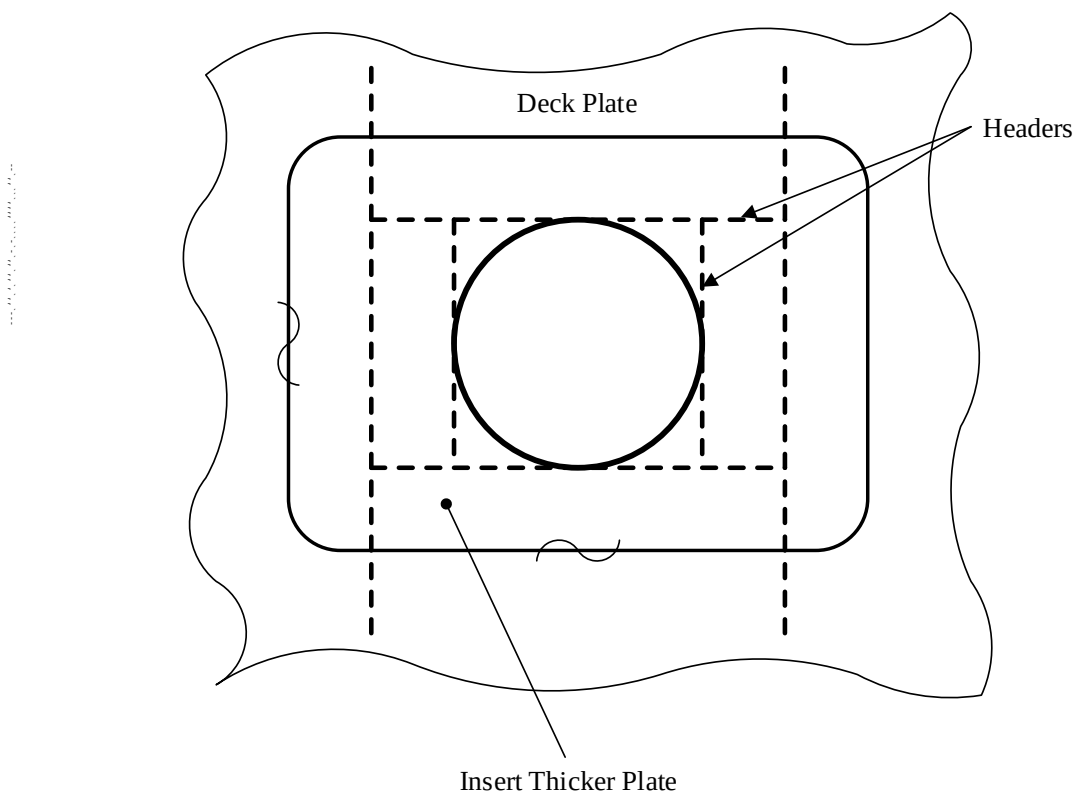
21 Testing

Tank testing is to be as required by Section 3-4-1.

23 Deck Fittings (2017)

All barges are to have a sufficient number of cleats and chocks of substantial design. The structure in way of these fittings is to be suitably reinforced by installation of headers, additional beams, brackets or doubling plates. See 3-1-2/Figure 2 below:

FIGURE 2
Reinforcing Structure in Way of Deck Fittings (2017)



PART 3

CHAPTER 2 Hull Structures and Arrangements

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PART

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CHAPTER 2 Hull Structures and Arrangements

SECTION 1 Longitudinal Strength

1 General

Barges intended to be classed for unrestricted ocean service are to have longitudinal strength in accordance with the requirements of this Section. A breadth to depth ratio up to approximately 4 is acceptable in association with longitudinal bulkheads and trusses arranged at suitable intervals.

3 Longitudinal Hull Girder Strength

3.1 Strength Standard

The required hull girder section modulus SM_R amidships, to the deck and bottom is to be obtained from the following equation:

$$SM_R = K SM_b \quad \text{cm}^2\text{-m (in}^2\text{-ft)}$$

Where

$$K = 0.629 + M_s/(fp SM_b) \text{ but is not to be taken less than 1.0}$$

$$M_s = \text{maximum still-water bending moment in the governing loaded or ballasted condition in kN-m (tf-m, Ltf-ft). When still-water bending moment calculations are not submitted, } K \text{ will be taken as 1.0.}$$

$$fp = 17.5 \text{ kN/cm}^2 (1.784 \text{ tf/cm}^2, 11.33 \text{ Ltf/in}^2)$$

$$SM_b = C_1 C_2 L^2 B (C_b + 0.7) \text{ cm}^2\text{-m (in}^2\text{-ft)}$$

$$C_1 = 4.11 \quad 30 \leq L < 45 \text{ m}$$

$$= 16.33(L/100)^2 - 15.47(L/100) + 7.77 \quad 45 \leq L < 95 \text{ m}$$

$$= 10.75 - \left(\frac{300 - L}{100} \right)^{1.5} \quad 95 \leq L \leq 300 \text{ m}$$

$$= 10.75 \quad 300 < L < 350 \text{ m}$$

$$= 10.75 - \left(\frac{L - 350}{150} \right)^{1.5} \quad 350 \leq L \leq 500 \text{ m}$$

$$= 4.11 \quad 100 \leq L < 150 \text{ ft}$$

$$= 16.33(L/328)^2 - 15.47(L/328) + 7.77 \quad 150 \leq L < 310 \text{ ft}$$

$$= 10.75 - \left(\frac{984 - L}{328} \right)^{1.5} \quad 310 \leq L \leq 984 \text{ ft}$$

$$= 10.75 \quad 984 < L < 1148 \text{ ft}$$

$$= 10.75 - \left(\frac{L - 1148}{492} \right)^{1.5} \quad 1148 \leq L \leq 1640 \text{ ft}$$

$$C_2 = 0.01 (1.44 \times 10^{-4})$$

$$L = \text{length, in meters (feet), as defined in 3-1-1/3}$$

$$B = \text{breadth, in meters (feet), as defined in 3-1-1/5}$$

$$C_b = \text{block coefficient, as defined in 3-1-1/31}$$

3.3 Section Modulus Calculation

In general, the following items may be included in the calculation of the section modulus, provided they are continuous or effectively developed throughout the midship $0.4L$ and gradually tapered beyond. The sectional areas of the decks may be gradually reduced to one half of the amidships deck area at $0.15L$ from the ends.

- Deck plating (strength deck and other effective decks)
- Shell and inner-bottom plating
- Deck and bottom girders
- Plating and longitudinal stiffeners of longitudinal bulkheads, longitudinals of deck, sides, bottom and inner bottom.

In general, the net sectional areas of longitudinal-strength members are to be used in the hull girder section modulus calculations. The section modulus to the deck or bottom is obtained by dividing the moment of inertia by the distance from the neutral axis to the molded deck line at side amidships plus the height of an effective trunk, if fitted (see 3-2-3/3), or to the baseline, respectively.

Where strength deck longitudinal hatch coamings of length greater than $0.14L$ are effectively supported by underdeck longitudinal bulkheads or deep girders, the coaming and longitudinal stiffeners are to be in accordance with 3-2-9/5.9. The section modulus amidships to the top of the coaming is to be obtained by dividing the moment of inertia by the distance from the neutral axis to the deck at side plus the coaming height. This distance need not exceed y_t as given by the following equation, provided y_t is not less than the distance to the molded deck line at side.

$$y_t = y(0.9 + 0.2 x/B) \text{ m (ft)}$$

where

$$y = \text{distance, in m (ft), from the neutral axis to the top of the continuous coaming}$$

$$x = \text{distance, in m (ft), from the top of the continuous coaming to the centerline of the barge}$$

$$B = \text{breadth of the barge as defined in 3-1-1/5 in m (ft)}$$

x and y are to be measured to the point giving the largest value of y_t . In way of continuous hatch coamings, the section modulus to the deck at side, excluding the coamings, need not be determined.

5 Hull Girder Moment of Inertia

The hull girder moment of inertia I amidships is to be not less than obtained from the following equation:

$$I = 0.03SM_R L \text{ cm}^2\text{-m}^2 (\text{in}^2\text{-ft}^2)$$

where

$$L = \text{length of barge as defined in 3-1-1/3}$$

$$SM_R = \text{hull girder section modulus required for the barge per 3-2-1/3.1, in cm}^2\text{-m (in}^2\text{-ft)}$$

7 Still-water Bending Moment and Shear Force Calculations (2015)

Still-water bending moment and shear force calculations are to be submitted for barges of 76 meters (250 feet) in length and above. They are to include at least the full load and ballast conditions and any contemplated loading conditions that might be expected to have an unfavorable influence on the hull girder strength. Where bending moment calculations indicate maximum values outside the midship 0.4L, the midship scantlings may be required to be extended.

Still-water bending moment and shear force calculations are also to be submitted for chemical tank barges with independent tanks, irrespective of their length.

These calculations are to show bending moment and shear force values along the length of the barge.

In general, the thickness of the side shell and longitudinal bulkhead plating is to be such that calculated hull-girder shearing stress based on still-water conditions does not exceed 58 N/mm² (5.91 kgf/mm², 8406 psi) at the quarter-length points of the barge, 74 N/mm² (7.55 kgf/mm², 10667.5 psi) at amidships and at the ends. Elsewhere values are to be interpolated.

9 Barges on Station

Barges, such as accommodation barges, intended for operation at one site may be specially considered.

11 Longitudinal Strength with Higher-Strength Materials

11.1 General

Barges in which the effective longitudinal material of either the upper or lower flanges of the main hull girder, or both, is constructed of materials having mechanical properties greater than those of ordinary-strength hull structural steel, are to have longitudinal strength generally in accordance with the preceding paragraphs of this Section, but the value of the hull girder section moduli may be modified as permitted by the following paragraphs. Applications of higher-strength material are to be continuous over the length of the barge to locations where the stress levels are suitable for the adjacent mild-steel structure. Higher-strength steel is to be extended to suitable locations below the strength deck and above the bottom, so that the stress levels will be satisfactory for the remaining mild steel structure. Longitudinal framing members are to be continuous throughout the required extent of higher-strength steel. Calculations showing that adequate strength has been provided against buckling are to be submitted for review, and care is to be taken against the adoption of reduced thicknesses of material that may be subject to damage during normal operation.

11.3 Hull Girder Section Modulus

When either the top or bottom flange of the hull girder, or both, is constructed of higher-strength material, the section modulus as obtained from 3-2-1/3.1 may be reduced by the factor Q .

$$SM_{hts} = Q (SM_R)$$

where

$$Q = 0.78 \text{ for H32 strength steel}$$

$$Q = 0.72 \text{ for H36 strength steel}$$

$$\text{H32, H36} = \text{as specified in Section 2-1-3 of the ABS Rules for Materials and Welding (Part 2)}$$

Q factor for steels having other yield points or yield strengths will be specially considered.

11.5 Hull Girder Moment of Inertia (2012)

The hull-girder moment of inertia is to be not less than required by 3-2-1/5 using the mild steel section modulus obtained from 3-2-1/3.1.

13 Buckling Calculations (2017)

Where buckling calculations are required to be submitted to verify the acceptability of the thickness of decks, shell, longitudinal bulkheads, hatch side coamings etc., per 3-2-2/3.5 or where special consideration is required, the total hull girder bending moment to be used in the calculations is to consist of the maximum still-water bending moment in kN-m, (tf-m, Ltf-ft) plus a wave-induced bending moment of $S_w SM_b$, kN-m (tf-m, Ltf-ft) where $S_w = 11.0 \text{ kN/cm}^2$ (1.122 tf/cm^2 , 7.123 Ltf/in^2) and SM_b is as defined in 3-2-1/3.1.

Buckling calculations are to be in accordance with Appendix 3-2-A4 of the *ABS Rules for Building and Classing Steel Vessels (Steel Vessel Rules)*.

Buckling calculations for barges of specialized services are to be in accordance with Part 5C, "Specific Vessel Types" of the *Steel Vessel Rules*.

Consideration may be given to the wave-induced bending moment calculated by means of a statistical analysis based on the ship motion calculation in realistic sea states. In such cases, the calculations, computer programs used, and the computed results are to be submitted for review.

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CHAPTER 2 Hull Structures and Arrangements

SECTION 2 Shell Plating

1 Shell Plating Thickness

Shell plating thickness is not to be less than is required for purposes of longitudinal hull girder strength in accordance with 3-2-1/3, nor is it to be less than required by the respective equations for minimum thickness of side and bottom plating in this Section. In general, after all corrections are made, the shell plating thickness is not to be less than required by Section 3-2-7 for tank bulkhead plating with h to the deck at side. Where hull girder shear values are abnormal, the thickness of the side shell plating may be required to be increased.

3 Shell Plating Amidships

3.1 Side Shell Plating Amidships

The thickness of the side shell plating within $0.4L$ amidships, as defined in 3-1-1/19, is not to be less than obtained from the following equations nor less than required by 3-2-2/5.1:

$$t = 0.07L + 0.007s \text{ mm} \quad \text{for } L \leq 150 \text{ meters}$$

$$t = 0.03L + 0.007s + 6.0 \text{ mm} \quad \text{for } L > 150 \text{ meters}$$

$$t = 0.00084L + 0.007s \text{ in.} \quad \text{for } L \leq 492 \text{ feet}$$

$$t = 0.00036L + 0.007s + 0.236 \text{ in.} \quad \text{for } L > 492 \text{ feet}$$

where

t = required thickness of plating, in mm (in.)

L = length of the barge, as defined in 3-1-1/3

s = frame spacing, in mm (in.)

3.1.1 Barges with Longitudinal Bulkheads

Where longitudinal bulkheads are fitted on each side of the centerline throughout the cargo space or extending not less than the midship $0.5L$, and located not more than $0.2B$ from the side of the barge, the side shell thickness, as obtained above, may be reduced by 0.5 mm (0.02 in.).

3.1.2 Transverse Framing

Where the side shell is transversely framed and the frame spacing adopted is greater than 760 mm (30 in.), calculations to show adequate provision against buckling are to be submitted.

3.3 Sheer Strake

In general, the thickness of the sheer strake is not to be less than the thickness of the side shell plating nor less than the required deck stringer strake thickness in the same section being considered.

3.5 Bottom Shell Plating

The thickness of the bottom shell plating within $0.4L$ amidships, as defined in 3-1-1/21, is not to be less than that obtained from the following equations nor less than required by 3-2-2/5.1:

3.5.1 Longitudinal Framing

$$\begin{aligned} t &= 0.045L + 0.007s + 1.8 \text{ mm} && \text{for } L \leq 123 \text{ meters} \\ t &= 0.08L + 0.007s - 2.5 \text{ mm} && \text{for } L > 123 \text{ meters} \\ t &= 0.00054L + 0.007s + 0.07 \text{ in.} && \text{for } L \leq 405 \text{ feet} \\ t &= 0.00096L + 0.007s - 0.1 \text{ in.} && \text{for } L > 405 \text{ feet} \end{aligned}$$

where

$$\begin{aligned} t &= \text{required thickness of plating, in mm (in.)} \\ L &= \text{length of the barge, as defined in 3-1-1/3, but need not be greater than 225 m (738 ft)} \\ s &= \text{frame spacing, in mm (in.)} \end{aligned}$$

3.5.2 Transverse Framing

In general, the thickness is to be 0.75 mm (0.03 in.) greater than obtained from the above equations.

Calculations to show adequate provision against buckling are to be submitted where the barge length $L > 76$ meters (250 feet).

5 Shell Plating at Ends

5.1 Minimum Shell Plating Thickness

The minimum shell plating thickness for $0.1L$ at ends is to be obtained from the following equations. Between the midship $0.4L$ and the end $0.1L$, the thickness of the plating may be gradually tapered.

$$\begin{aligned} t &= 0.055L + 0.007s + 1.0 \text{ mm} && \text{for } L \leq 76 \text{ meters} \\ t &= 0.015L + 0.01s + 2.2 \text{ mm} && \text{for } L > 76 \text{ meters} \\ t &= 0.00066L + 0.007s + 0.04 \text{ in.} && \text{for } L \leq 250 \text{ feet} \\ t &= 0.00018L + 0.01s + 0.087 \text{ in.} && \text{for } L > 250 \text{ feet} \end{aligned}$$

where

$$\begin{aligned} t &= \text{required thickness of plating, in mm (in.)} \\ L &= \text{length of the barge, as defined in 3-1-1/3, but need not be greater than 225 m (738 ft)} \\ s &= \text{frame spacing, in mm (in.)} \end{aligned}$$

5.3 Bottom Forward Plating

The thickness of the bottom forward plating, as defined in 3-1-1/33, is not to be less than that obtained from the following equations. However, it need not exceed 25.4 mm (1 in.).

$$\begin{aligned} t &= 0.055L + 0.01s + 1.0 \text{ mm} && \text{for } L \leq 110 \text{ meters} \\ t &= 0.085L + 0.01s - 2.3 \text{ mm} && \text{for } L > 110 \text{ meters} \\ t &= 0.00066L + 0.01s + 0.04 \text{ in.} && \text{for } L \leq 360 \text{ feet} \\ t &= 0.00102L + 0.01s - 0.09 \text{ in.} && \text{for } L > 360 \text{ feet} \end{aligned}$$

where

- t = required thickness of plating, in mm (in.)
 L = length of the barge, as defined in 3-1-1/3, but need not be greater than 225 m (738 feet)
 s = frame spacing, in mm (in.)

5.5 Immersed Bow Plating

Where the bow is of ship-shape form, the thickness of the plating below the waterline for the forward 0.16L is not to be less than obtained from the following equations, but need not be greater than the thickness of the side shell plating amidships.

$$t = 0.05L + 0.009s + 1.0 \text{ mm}$$

$$t = 0.0006L + 0.009s + 0.04 \text{ (in.)}$$

where

- t = required thickness of plating in mm (in.)
 L = length of the barge, as defined in 3-1-1/3
 s = frame spacing, in mm (in.)

7 Shell Recesses

Recesses in shell plating to serve as ladders are to have well rounded corners and in general are to be staggered vertically with the recessed plating specially reinforced where forming pockets. The side shell longitudinals in way of shell recesses are to remain intact or the strength of the longitudinals is to be developed.

9 Bow and Stern Thruster Tunnels

The thickness of the tunnel plating is to be not less than required by 3-2-2/5.1, nor is the thickness to be less than obtained from the following equation:

$$t = 0.008d + 3.0 \text{ mm}$$

$$t = 0.008d + 0.12 \text{ in.}$$

where

- d = inside diameter of the tunnel, in mm (in.), but is to be taken not less than 970 mm (38 in.)

Where the outboard ends of the tunnel are provided with bars or grids, the bars or grids are to be effectively secured.

11 Bilge Keels

Bilge keels, where fitted, are to be attached to the shell by a doubler. In general, both the bilge keel and the doubler are to be continuous. The connection of the bilge keel to the doubler and the doubler to the shell are to be by double continuous fillet welds.

Butt welds in the bilge keel and doubler are to be full penetration and are to be kept clear of master erection butts. In general, shell butts are to be flush in way of the doubler; doubler butts are to be flush in way of the bilge keel, and, in general, scallops and cutouts are not to be used. Where desired, a drilled crack arresting hole at least 25 mm (1 in.) in diameter may be provided in the bilge keel butt weld as close as practical to the doubler.

The ends of the bilge keel are to be suitably tapered and are to terminate on an internal stiffening member. The material tensile properties for bilge keels and doublers are to be as required for the bottom shell plating.

12 Bilge Plating (2016)

In general, the bilge plate is to be longitudinally stiffened. The thickness of the bilge plate is to be not less than required in 3-2-2/3 and 3-2-2/5, adjusted for spacing of the bilge longitudinals or frames and the material factors. Where girth spacing of bilge longitudinals is greater than that of the adjacent bottom plating, the spacing may be modified by the following equation in calculations of minimum required thickness.

$$s = k_{r1} s_g \text{ mm (in.), but not to be taken less than the spacing of the longitudinals of the adjacent bottom plating}$$

where

$$s_g = \text{girth spacing of bilge longitudinals, in mm (in.)}$$

$$k_{r1} = (1 - 0.5s_g/R)^2 \text{ but not less than 0.55}$$

$$R = \text{radius of bilge, in mm (in.)}$$

Bilge keels are not to be considered as longitudinal stiffening members unless they are continuous and effectively developed.

In no case is the thickness of the bilge plate to be less than that of the adjacent bottom plating.

13 Higher-strength Materials

13.1 General

In general, applications of higher-strength materials for shell plating are to take into consideration the suitable extension of the higher-strength material above and below the bottom and deck, respectively (for longitudinal extent, see 3-2-1/11.1). Calculations to show adequate provision against buckling are to be submitted. Care is to be exercised against the adoption of reduced thicknesses of material that might be subjected to damage during normal operation. The thicknesses of bottom and side-shell plating, where constructed of higher-strength materials, are to be not less than required for purposes of longitudinal hull girder strength. The actual bottom/side plate thicknesses are also not to be less than those required in the previous paragraph, corrected using the Q factor, as specified below.

13.3 Bottom Plating of Higher-strength Material

Bottom shell plating, where constructed of higher-strength material, is to be not less in thickness than obtained from the following equation:

$$t_{hts} = (t_{ms} - C) Q + C$$

where

$$t_{hts} = \text{thickness of higher-strength material, in mm (in.)}$$

$$t_{ms} = \text{thickness, in mm (in.), of ordinary-strength steel, as required by 3-2-2/3.5}$$

$$C = 0.3 t_{ms}, \text{ but need not be greater than 4.3 mm (0.17 in.)}$$

$$Q = \text{as defined in 3-2-1/11.3}$$

The thickness of bottom shell plating, where transversely framed, will be specially considered.

13.5 Side Plating of Higher-strength Material

Side shell plating, where constructed of higher-strength material, is to be not less in thickness than obtained from the following equations:

$$t_{hts} = [t_{ms} - C][(Q + 2\sqrt{Q})/3] + C$$

where t_{hts} , t_{ms} , C and Q are as defined in 3-2-2/13.3.

The thickness of side shell plating, where transversely framed, will be specially considered.

13.7 End Plating

End plating thicknesses, including immersed bow plating and plating on the flat of bottom forward, where constructed of higher-strength materials, will be subject to special consideration.

PART

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CHAPTER 2 Hull Structures and Arrangements

SECTION 3 Decks

1 Deck Plating

1.1 Deck Plating Thickness

The strength deck plating is to be of the thickness necessary to obtain the required hull girder section modulus. The thickness outside the longitudinal line of the openings, or completely across the barge where there are no centerline openings, is not to be less than obtained from the equations in 3-2-3/1.1.1 or 3-2-3/1.1.2 below, except within steel deckhouses, where the plating may be 1 mm (0.04 in.) less. The requirements of equations 3-2-3/1.1.1(b) and 3-2-3/1.1.2(b) are to extend over 0.4L amidships, beyond which they may be gradually reduced in the manner permitted for strength deck area in 3-2-1/3.3. The thickness requirements of 3-2-3/1.1.1(a) and 3-2-3/1.1.2(a) are to extend over the 0.8L amidships.

1.1.1 Thickness of Strength Decks with Transverse Beams in Barges Over 91.5 m (300 ft) up to 183 m (600 ft) in Length

Thickness of strength decks with transverse beams in barges over 91.5 m (300 ft) up to 183 m (600 ft) in length is to be not less than 3-2-3/1.1.1(a) and 3-2-3/1.1.1(b) below:

1.1.1(a)

$$t = 0.01s + 2.3 \text{ mm} \quad \text{for } s \leq 760 \text{ mm}$$

$$t = 0.0066s + 4.9 \text{ mm} \quad \text{for } s > 760 \text{ mm}$$

$$t = 0.01s + 0.09 \text{ in.} \quad \text{for } s \leq 30 \text{ in.}$$

$$t = 0.0066s + 0.192 \text{ in.} \quad \text{for } s > 30 \text{ in.}$$

1.1.1(b)

$$t = \frac{s(L + 45.73)}{25L + 6082} \text{ mm}$$

$$t = \frac{s(L + 150)}{25L + 19950} \text{ in.}$$

1.1.2 Thickness of Strength Decks with Longitudinal Beams, Strength Decks with Transverse Beams in Barges 91.5 m (300 ft) or Less and Forecastle Decks in Barges over 122 m (400 ft)

Thickness of strength decks with longitudinal beams is to be not less than 3-2-3/1.1.2(a) and 3-2-3/1.1.2(b), below. Thickness of strength decks with transverse beams in barges 91.5 m (300 ft) or less is to be not less than 3-2-3/1.1.2(a) and 3-2-3/1.1.1(b). Thickness of forecastle decks in barges over 122 m (400 ft) is to be not less than 3-2-3/1.1.2(a), below.

1.1.2(a)

$$t = 0.009s + 2.4 \text{ mm} \quad \text{for } s \leq 760 \text{ mm}$$

$$t = 0.006s + 4.7 \text{ mm} \quad \text{for } s > 760 \text{ mm}$$

$$t = 0.009s + 0.095 \text{ in.} \quad \text{for } s \leq 30 \text{ in.}$$

$$t = 0.006s + 0.185 \text{ in.} \quad \text{for } s > 30 \text{ in.}$$

1.1.2(b)

$$t = \frac{s(L + 48.76)}{26L + 8681} \text{ mm} \quad \text{for } L \leq 183 \text{ m}$$

$$t = \frac{24.38s}{1615.4 - 1.1L} \text{ mm} \quad \text{for } L > 183 \text{ m}$$

$$t = \frac{s(L + 160)}{26L + 28482} \text{ in.} \quad \text{for } L \leq 600 \text{ ft}$$

$$t = \frac{80s}{5300 - 1.1L} \text{ in.} \quad \text{for } L > 600 \text{ ft}$$

1.1.3 Thickness of Exposed Strength Decks within Line of Openings, Forecastle Decks in Barges of 122 m (400 ft) in Length or Less

$$t = 0.01s + 0.9 \text{ mm} \quad \text{for } s \leq 760 \text{ mm}$$

$$t = 0.0067s + 3.4 \text{ mm} \quad \text{for } s > 760 \text{ mm}$$

$$t = 0.01s + 0.035 \text{ in.} \quad \text{for } s \leq 30 \text{ in.}$$

$$t = 0.0067s + 0.134 \text{ in.} \quad \text{for } s > 30 \text{ in.}$$

1.1.4 Thickness of Platform Decks in Enclosed Cargo Spaces

$$t = 0.00395s\sqrt{h} + 1.5 \text{ mm} \quad \text{but not less than 5.0 mm}$$

$$t = 0.00218s\sqrt{h} + 0.06 \text{ in.} \quad \text{but not less than 0.20 in.}$$

where

h = tween deck height, in meters (feet). When a design load is specified, h is to be taken as $p/7.070$ m ($p/0.721$ m, $p/45$ ft.)

p = uniformly distributed deck loading, in kN/m^2 (tf/m^2 , lbf/ft^2)

1.1.5 Thickness of Enclosed Platform Decks not Intended for Cargo

$$t = 0.0058s + 1.0 \text{ mm} \quad t = 0.0058s + 0.04 \text{ in.}$$

but not less than 4.5 mm (0.18 in.)

where

L = length of the barge, as defined in 3-1-1/3, in m (ft)

s = spacing of deck beams, in mm (in.)

1.3 Plating within Line of Openings

Within the longitudinal line of openings, the thickness of exposed strength deck plating is to be not less than obtained from the equation in 3-2-3/1.1.3 amidships. At the forward and after ends it is to be as required by 3-2-3/1.7. Within steel deckhouses, the plating may be of the thickness obtained from the equation in 3-2-3/1.1.4.

1.5 Plating In Way of Deck Cargo

Where cargo is to be carried on deck, the deck thickness is not to be less than obtained from the appropriate equations in 3-2-3/1.1.1, 3-2-3/1.1.2 or 3-2-3/1.1.3, nor is the deck thickness to be less than is required for platform decks in enclosed cargo spaces per 3-2-3/1.1.4.