



RULES FOR BUILDING AND CLASSING

STEEL VESSELS 2018

PART 5C SPECIFIC VESSEL TYPES (CHAPTERS 7-13)

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

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Rule Change Notice (2018)

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

Listing by Effective Dates of Changes from the 2017 Rules

Notice No. 1 (effective on 1 July 2017) to the 2017 Rules, which is incorporated in 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>
5C-9-3/9 (ABS) (New)	Location of Fuel Tanks in Cargo Area	To clarify the requirements for fuel tanks used for separating machinery spaces from cargo and slop tanks, in line with IACS UR M76, Apr. 2016. (Incorporates Notice No. 1)
5C-9-3/Figure 5 (ABS) (New)	Cargo Tank Block	To clarify the requirements for fuel tanks used for separating machinery spaces from cargo and slop tanks, in line with IACS UR M76, Apr. 2016. (Incorporates Notice No. 1)
5C-13-1/1 (ABS) (New)	Classification Notations	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-1/3 (ABS) (New)	Certification	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-2/1 (ABS) (New)	Application	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-2/2.4 (ABS)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-2/2.42 (ABS) through 5C-13-2/2.50 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-4/2.2 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-5/1 (ABS) (New)	Plans and Data to be Submitted	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-5/3.6 (ABS) (New)	Access in way of Fuel Containment Systems	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-5/6.1 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)

Part/Para. No.	Title/Subject	Status/Remarks
5C-13-5/6.6 (ABS) (New)	Interpretation	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-5/6.8 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-5/7.2 (ABS) (New)	Interpretation	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-5/8 (ABS) (New)	Interpretation	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-5/10.1 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-5/10.6 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-5/10.7 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/1 (ABS) (New)	Submission of Data	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/3.7 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/3.10 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/4.1.1 (ABS) (New)	Interpretation	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/4.4 (ABS) (New)	Interpretation of 5C-13-6/4.4.6	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/4.6.1 (ABS) (New)	Interpretation of 5C-13-6/4.6.1 (Permissible Stress in way of Supports of Type C Fuel Tanks)	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/Figure 2 (ABS) (New)	Determination of Liquid Height Z_{β} for Points 1, 2 and 3	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/ 4.13.1.1.4 (ABS) (New)	Interpretation of 5C-13-6/4.13.1.1.4	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/4.15.3.1 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/ 4.15.3.2.5.2 (ABS) (New)	Interpretation	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/5.11 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)

Part/Para. No.	Title/Subject	Status/Remarks
5C-13-6/6.1 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/6.4 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/9.1.1 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/9.3.3 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/9.4.2 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/13 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/14.1 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/14.4 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6/14.5 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6A2 (ABS) (New)	Reliquefaction Systems	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-6A3 (ABS) (New)	Gas Combustion Units	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-7/3.3.3 (ABS) (New)	Pressure Surge Protection	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-7/3.5.2 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-7/3.6.1 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-7/3.6.3 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-7/4.1	Metallic materials	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-7/Table 2 (ABS) (New)	Requirements for Design Temperatures Below 0°C (32°F) and Down to –55°C (–67°F)	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-8/1 (ABS) (New)	Plans and Data to be Submitted	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)

Part/Para. No.	Title/Subject	Status/Remarks
5C-13-8/2 (ABS) (New)	General	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-8/3.1.3 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-8/4.2 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-8/4.3 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-8/5.3 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-8/5.7 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-8/5.9 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-8/6 (ABS) (New)	Gas Detection	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-9/1 (ABS) (New)	Plans and Data to be Submitted	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-9/2 (ABS) (New)	General	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-9/3.4 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-9/4.1 (ABS) (New)	Tank Valves	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-9/4.2 (ABS) (New)	Interpretation	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-9/4.11 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-9/4.12 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-9/4.13 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-9/4.14 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-9/4.15 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)

Part/Para. No.	Title/Subject	Status/Remarks
5C-13-9/6.1.2 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-9/10 (ABS) (New)	Vaporizers, Heaters and Pressure Vessels	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-9/11 (ABS) (New)	LNG Pumps	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-9/12 (ABS) (New)	Ancillary Systems	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/1 (ABS) (New)	Plans and Data to be Submitted	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/2.3 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/2 (ABS) (New)	Condition	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.1.1(a) (ABS) (New)	Interpretation – Engine Exhaust System Explosion Relief	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.1.1(b) (ABS) (New)	Engine Exhaust System Purging	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.1.4 (ABS) (New)	Interpretation – Auxiliary System Venting	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.1.7 (ABS) (New)	Interpretation	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.1.8 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.1.9 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.1.10 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.1.11 (ABS) (New)	Engine Combustion Air Intakes	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.1.12 (ABS) (New)	Air Inlet Manifolds	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.1.13 (ABS) (New)	Protection of Crankcase	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.1.14 (ABS) (New)	Protection Against Explosion	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)

<i>Part/Para. No.</i>	<i>Title/Subject</i>	<i>Status/Remarks</i>
5C-13-10/3.1.15 (ABS) (New)	Gas Valve Unit (GVU)/Gas Valve Train (GVT) Room/Enclosure	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.2.2 (ABS) (New)	Interpretation	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.2.2 (ABS) (New)	Testing	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/3.5 (ABS) (New)	“Pre-Mixed” Gas Fuel Engines	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/4.3 (ABS) (New)	Boiler Burners	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/4.12 (ABS) (New)	Boiler Casings	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10/5.8 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-10A1 (ABS) (New)	Dual Fuel Gas Turbine Propulsion System	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-11/3.3 (ABS) (New)	Interpretation	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-11/7/1 (ABS) (New)	Interpretation of 5C-13-11/7.1	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-12/3.3 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-12/3.4 (ABS) (New)	Explosion Protection, ESD-Protected Machinery Spaces	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-12/5.2.3	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-12/5.2.6	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-12/5.2 Note 23	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-12/5.3.3 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-13/5.1.1 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-13/5.1.2 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)

<i>Part/Para. No.</i>	<i>Title/Subject</i>	<i>Status/Remarks</i>
5C-13-13/5.2 (ABS) (New)	Interpretation	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-13/5.4 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-13/6.2 (ABS) (New)	Interpretation	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-13/8.3 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/2.2 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/4.12 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/5.2 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/5.4 (ABS) (New)	Bunkering Emergency Shutdown	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/6.1 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/6.2 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/6.3 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/7.1 (ABS) (New)	Engine Control and Monitoring Systems	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/8.4 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/8.10 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/8.11 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/8.12 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/8.13 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/11.3 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)

Part/Para. No.	Title/Subject	Status/Remarks
5C-13-15/11.5 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/Table 2 (ABS) (New)	Monitoring and Safety System Functions for Fuel Tanks	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/Table 3 (ABS) (New)	Monitoring and Safety System Functions for Fuel Bunkering Systems	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/Table 4 (ABS) (New)	Instrumentation and Alarms for Gas Compressors and LNG Pumps	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/Table 5 (ABS) (New)	Monitoring and Safety System Functions for Fuel Gas Supply Systems	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/Table 6 (ABS) (New)	Instrumentation and Alarms in Centralized Control Stations for the Reliquefaction Systems	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/Table 7 (ABS) (New)	Instrumentation and Alarms in Centralized Control Stations for the GCU	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/Table 8 (ABS) (New)	Monitoring and Safety System Functions for Engines	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-15/Table 9 (ABS) (New)	Monitoring and Safety System Functions for Dual Fuel Gas Turbine and Supply Systems	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/1.1 (ABS) (New)	Interpretation of 5C-13-16/1.1	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/2 (ABS) (New)	Interpretation	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/Figure 3 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/Figure 4 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/Figure 5 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/Figure 6 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/6.2 (ABS) (New)	Type C Independent Tanks	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/7.1 (ABS) (New)	Interpretation of 5C-13-7/7.1 Valves	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/7.2.7 (ABS) (New)	Interpretation	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)

<i>Part/Para. No.</i>	<i>Title/Subject</i>	<i>Status/Remarks</i>
5C-13-16/8 (ABS) (New)	Surveys during Construction	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/Table 1 (ABS) (New)	Certification of Fuel Tanks and Fuel Storage Hold Space	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/Table 2 (ABS) (New)	Certification of Reliquefaction Systems	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/Table 3 (ABS) (New)	Certification of Gas Combustion Units	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/Table 4 (ABS) (New)	Certification of Bunkering Systems	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/Table 5 (ABS) (New)	Certification of Fuel Gas Supply Systems	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/Table 6 (ABS) (New)	Certification Guidance for Fuel Gas Supply System Components	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/Table 7 (ABS) (New)	Certification of Engines	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-16/Table 8 (ABS) (New)	Certification of Dual Fuel Gas Turbines	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-18/3.4 (ABS) (New)	Operating and Maintenance Instruction Manuals	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-18/4.2.1.7 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-18/ 4.2.1.10 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-18/ 4.2.1.11 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-18/ 4.2.1.12 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-18/ 4.2.1.13 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (Incorporates Notice No. 1)
5C-13-18/4.5 (ABS) (New)	<No Title>	To incorporate guidance from the <i>ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships</i> into the Rules. (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>
5C-8-1/1.3 (ABS) (New)	Liquefied Natural Gas Carriers	To incorporate the <i>ABS Guide for Propulsion Systems for LNG Carriers</i> into the Rules and align the requirements with the revised IGC Code and recent developments with gas fueled engines.
5C-8-6/Table 2 (ABS)	Requirements for Design Temperatures Below 0°C (32°F) and Down to -55°C (-67°F)	To include marking for the new strength level.
5C-8-6/Table 4	Pipes (Seamless and Welded), forgings and Castings for Cargo and Process Piping for Design Temperatures Below 0°C and Down to -165°C	To not rule out the impact testing requirement for austenitic stainless steels, in certain cases.
5C-8-7/3 (ABS)	Cargo-refrigeration System	To incorporate the <i>ABS Guide for Propulsion Systems for LNG Carriers</i> into the Rules and align the requirements with the revised IGC Code and recent developments with gas fueled engines.
5C-8-7/4.5 (ABS) (New)	<No Title>	To incorporate the <i>ABS Guide for Propulsion Systems for LNG Carriers</i> into the Rules and align the requirements with the revised IGC Code and recent developments with gas fueled engines.
5C-8-13/6.18 (ABS) (New)	<No Title>	To incorporate the <i>ABS Guide for Propulsion Systems for LNG Carriers</i> into the Rules and align the requirements with the revised IGC Code and recent developments with gas fueled engines.
5C-8-16/4.2 (ABS) (New)	Restoration of Gas Fuel Supply	To incorporate the <i>ABS Guide for Propulsion Systems for LNG Carriers</i> into the Rules and align the requirements with the revised IGC Code and recent developments with gas fueled engines.
5C-8-16/4.5 (ABS) (New)	Block and Bleed Valves	To incorporate the <i>ABS Guide for Propulsion Systems for LNG Carriers</i> into the Rules and align the requirements with the revised IGC Code and recent developments with gas fueled engines.
5C-8-16/7.4 (ABS) (New)	<No Title>	To incorporate the <i>ABS Guide for Propulsion Systems for LNG Carriers</i> into the Rules and align the requirements with the revised IGC Code and recent developments with gas fueled engines.
5C-8-16/8.4 (ABS) (New)	<No Title>	To incorporate the <i>ABS Guide for Propulsion Systems for LNG Carriers</i> into the Rules and align the requirements with the revised IGC Code and recent developments with gas fueled engines.
5C-8-A5 (ABS) (New)	Reliquefaction System	To incorporate the <i>ABS Guide for Propulsion Systems for LNG Carriers</i> into the Rules and align the requirements with the revised IGC Code and recent developments with gas fueled engines.
5C-8-A6 (ABS) (New)	Gas Combustion Units/Thermal Oxidizers	To incorporate the <i>ABS Guide for Propulsion Systems for LNG Carriers</i> into the Rules and align the requirements with the revised IGC Code and recent developments with gas fueled engines.
5C-8-A7 (ABS) (New)	Dual Fuel Diesel and Single Gas Fuel Engines	To incorporate the <i>ABS Guide for Propulsion Systems for LNG Carriers</i> into the Rules and align the requirements with the revised IGC Code and recent developments with gas fueled engines.
5C-8-A8 (ABS) (New)	Dual Fuel Gas Turbine Propulsion System	To incorporate the <i>ABS Guide for Propulsion Systems for LNG Carriers</i> into the Rules and align the requirements with the revised IGC Code and recent developments with gas fueled engines.
5C-9-2/2	Freeboard and Stability	To incorporate the amendments to IBC Code in IMO MEPC.250(66) and MSC.369(93).
5C-9-2/2.6 (New)	<No Title>	To incorporate the amendments to IBC Code in IMO MEPC.250(66) and MSC.369(93).
5C-9-2/2.7 (New)	<No Title>	To incorporate the amendments to IBC Code in IMO MEPC.250(66) and MSC.369(93).

<i>Part/Para. No.</i>	<i>Title/Subject</i>	<i>Status/Remarks</i>
5C-12-4/7.7	Double Bottom Girders and Floors	To clarify that Part 5C, Chapter 12 does not consider the effect of partial girder effect while fully extended horizontal stringer considers partial stringer as load sharing members and that other alternative approaches such as grillage analysis or finite element analysis could be accepted.
5C-12-4/7.7.2	Double Bottom Centerline Girder – Net Thickness	To clarify that Part 5C, Chapter 12 does not consider the effect of partial girder effect while fully extended horizontal stringer considers partial stringer as load sharing members.
5C-12-4/7.7.3	Double Bottom Side Girder – Net Thickness	To clarify that Part 5C, Chapter 12 does not consider the effect of partial girder effect while fully extended horizontal stringer considers partial stringer as load sharing members.
5C-12-4/7.7.4	Double Bottom Floors – Net Thickness	To clarify that Part 5C, Chapter 12 does not consider the effect of partial girder effect while fully extended horizontal stringer considers partial stringer as load sharing members.
5C-12-4/11.1	General	To clarify that Part 5C, Chapter 12 does not consider the effect of partial girder effect while fully extended horizontal stringer considers partial stringer as load sharing members and that other alternative approaches such as grillage analysis or finite element analysis could be accepted.
5C-12-4/11.3.2	Web Thickness of Deck Transverses	To clarify that Part 5C, Chapter 12 does not consider the effect of partial girder effect while fully extended horizontal stringer considers partial stringer as load sharing members. To remove definitions of terms that are not related to the formulae of the net web thickness.
5C-12-4/11.5.1	Web Thickness of Deck Girder	To clarify that Part 5C, Chapter 12 does not consider the effect of partial girder effect while fully extended horizontal stringer considers partial stringer as load sharing members.
5C-12-4/11.7.2	Web Thickness of Double Side Transverses	To remove definitions of terms that are not related to the formulae of the net web thickness.
5C-12-4/15.3	Vertical Webs	To specify a maximum of 1.0 for β_1 and to remove definitions of terms that are not related to the formulae of the net web thickness.
5C-12-4/15.5.1	Fully Extended Horizontal Webs	To clarify that an adjustment may be made for the reduced area supported by the horizontal webs and to remove definitions of terms that are not related to the formulae of the net web thickness.
5C-13-1/1.2 (New)	Alternative Low Flashpoint Fueled Ship	To provide the ability to also apply Class requirements for the use of alternative low flashpoint fuels to all other ship types, and provide the applicable notation.
5C-13-1/1.7	Dual Fuel Diesel Engine Power Plant	To provide the ability to also apply Class requirements for the use of alternative low flashpoint fuels to all other ship types, and provide the applicable notation.

PART 5C

Specific Vessel Types

CONTENTS

CHAPTER 7	Vessels Intended to Carry Passengers	966
Section 1	Introduction	974
Section 2	Hull Structures	978
Section 3	Subdivision and Stability	1010
	Appendix 1 – Onboard Computers for Stability Calculations.....	1015
Section 4	Structural Fire Protection	1022
Section 5	Machinery Equipment and Systems	1049
Section 6	Fire Safety Systems.....	1076
Section 7	Additional Notations	1089
Appendix 1	IMO Guidance for Structural Fire Protection	1091
Appendix 2	International Standards for Windows.....	1092
CHAPTER 8	Vessels Intended to Carry Liquefied Gases in Bulk.....	1093
Section 1	General (ABS).....	1109
Section 2	Ship Survival Capability and Location of Cargo Tanks	1130
Section 3	Ship Arrangements	1147
Section 4	Cargo Containment.....	1158
Section 5	Process Pressure Vessels and Liquid, Vapour and Pressure Piping Systems.....	1199
Section 6	Materials of Construction and Quality Control	1215
Section 7	Cargo Pressure/Temperature Control	1234
Section 8	Vent Systems for Cargo Containment	1238
Section 9	Cargo Containment System Atmosphere Control	1248
Section 10	Electrical Installations	1251
Section 11	Fire Protection and Extinction.....	1255
Section 12	Artificial Ventilation in the Cargo Area	1261
Section 13	Instrumentation and Automation Systems	1264
Section 14	Personnel Protection.....	1272
Section 15	Filling Limits for Cargo Tanks	1274
Section 16	Use of Cargo as Fuel	1277
Section 17	Special Requirements.....	1286
Section 18	Operating Requirements.....	1300
Section 19	Summary of Minimum Requirements	1308

Appendix 1	Guidelines for the Uniform Application of the Survival Requirements of the Bulk Chemical Code and the Gas Carrier Code.....	1311
Appendix 2	United States Coast Guard Additional Design and Structural Requirements for Non-US Flag Vessels Operating on the Navigable Waters of the United States	1315
Appendix 3	Non-Metallic Materials	1317
Appendix 4	Standard for the Use of Limit State Methodologies in the Design of Cargo Containment Systems of Novel Configuration.....	1324
Appendix 5	Reliquefaction System (ABS)	1333
Appendix 6	Gas Combustion Units/Thermal Oxidizers (ABS)	1341
Appendix 7	Dual Fuel Diesel and Single Gas Fuel Engines (ABS)	1348
Appendix 8	Dual Fuel Gas Turbine Propulsion System (ABS)	1354
CHAPTER 9	Vessels Intended to Carry Chemical Cargoes in Bulk	1369
Section 1	General (ABS).....	1376
Section 2	Ship Survival Capability and Location of Cargo Tanks	1390
Section 3	Ship Arrangements	1400
Section 4	Cargo Containment.....	1409
Section 5	Cargo Transfer.....	1412
Section 6	Materials of Construction, Protective Linings and Coatings.....	1418
Section 7	Cargo Temperature Control.....	1420
Section 8	Cargo Tank Venting and Gas-Freeing Arrangements	1422
Section 9	Environmental Control	1428
Section 10	Electrical Installations	1432
Section 11	Fire Protection and Fire Extinction.....	1434
Section 12	Mechanical Ventilation in the Cargo Area.....	1438
Section 13	Instrumentation	1441
Section 14	Personnel Protection.....	1444
Section 15	Special Requirements.....	1447
Section 16	Operational Requirements	1472
Section 17	Summary of Minimum Requirements	1476
Section 18	List of Chemicals to Which the Code Does Not Apply.....	1517
Section 19	Index of Products Carried in Bulk	1519
Section 20	Transport of Liquid Chemical Wastes.....	1568
Section 21	Criteria for Assigning Carriage Requirements for Products Subject to the IBC Code	1570
Appendix 1	Guidelines for the Uniform Application of the Survival Requirements of the Bulk Chemical Code and the Gas Carrier Code.....	1583
Appendix 2	Calculation of the Capacity of Foam Systems for Chemical Tankers	1587
Appendix 3	Resolution A.567(14)	1589

CHAPTER 10	Vessels Intended to Carry Vehicles.....	1595
Section 1	Introduction	1598
Section 2	Vehicle Carrier	1600
Section 3	Vehicle Passenger Ferry.....	1608
Section 4	Cargo Safety	1609
	Appendix 1 – IMO Resolution A.123(V)	1616
	Appendix 2 – IMO MSC.1/Circ.1272	1618
	Appendix 3 – IMO MSC.1/Circ.1230	1632
CHAPTER 11	Vessels Intended to Carry Water	1636
Section 1	Introduction	1639
Section 2	General Requirements.....	1643
Section 3	Hull Structure	1647
Appendix 1	Hull Girder Shear Strength for Tankers	1663
CHAPTER 12	Liquefied Gas Carriers with Membrane Tanks	1667
Section 1	Introduction	1674
Section 2	Design Considerations and General Requirements	1677
Section 3	Load Criteria	1680
Section 4	Initial Scantling Criteria	1717
Section 5	Total Strength Assessment.....	1773
Section 6	Hull Structure Beyond 0.4L Amidships	1785
Appendix 1	Fatigue Strength Assessment of Bulk Carriers.....	1799
Appendix 2	Calculation of Critical Buckling Stresses	1826
CHAPTER 13	Vessels Using Gases or other Low-Flashpoint Fuels	1837
Section 1	General (ABS).....	1847
Section 2	General	1849
Section 3	Goal and Functional Requirements	1855
Section 4	General Requirements.....	1857
Section 5	Ship Design and Arrangement.....	1859
Section 6	Fuel Containment System	1868
	Appendix 1 – Standard for the Use of Limit State Methodologies in the Design of Fuel Containment Systems of Novel Configuration.....	1912
	Appendix 2 – Reliquefaction Systems (ABS).....	1921
	Appendix 3 – Gas Combustion Units (ABS)	1926
Section 7	Material and General Pipe Design.....	1931
Section 8	Bunkering.....	1943
	Appendix 1 – LNG Bunker Delivery Note.....	1947
Section 9	Fuel Supply to Consumers	1949

Section 10	Power Generation Including Propulsion and other Gas Consumers.....	1957
	Appendix 1 – Dual Fuel Gas Turbine Propulsion System (ABS).....	1965
Section 11	Fire Safety.....	1977
Section 12	Explosion Prevention	1980
Section 13	Ventilation	1983
Section 14	Electrical Installations	1988
Section 15	Control, Monitoring and Safety Systems	1990
Section 16	Manufacture, Workmanship and Testing	2004
Section 17	Drills and Emergency Exercises	2029
Section 18	Operation	2030
Section 19	Training	2035

PART 5C

CHAPTER 7 Vessels Intended to Carry Passengers (2013)

CONTENTS

SECTION 1	Introduction	974
1	General	974
1.1	Classification	974
1.3	Application	974
1.5	Scope	974
1.7	Passenger Ship Safety Certificate	974
1.9	Independent Review	975
1.11	Administration Approval	975
3	Definitions	975
3.1	General	975
3.3	"A" Class Division	975
3.5	Accommodation Spaces	975
3.7	Administration	975
3.9	"B" Class Division	975
3.11	Breadth	976
3.13	Bulkhead Deck	976
3.15	"C" Class Division	976
3.17	Deepest Subdivision Load Line	976
3.19	Draft	976
3.21	Effective Superstructures and Deckhouses	976
3.23	Fire Test Procedures Code	976
3.25	Length	976
3.27	Machinery Spaces	976
3.29	Machinery Spaces of Category A	976
3.31	Margin Line	976
3.33	Passenger	976
3.35	Passenger Spaces	977
3.37	Public Spaces	977
3.39	Regulations	977
3.41	Service Spaces	977
3.43	Short International Voyage	977
3.45	Special Category Spaces	977
3.47	Steel or Other Equivalent Material	977
3.49	Strength Deck	977
3.51	Subdivision Load Line	977

SECTION 2	Hull Structure	978
1	General	978
1.1	General Structural Requirements	978
1.3	Structural Sections	978
1.5	Required Structural Drawings.....	979
3	Longitudinal Strength	979
3.1	General.....	979
3.3	Calculation of Hull Girder Section Modulus	979
3.5	Bending Moment and Shear Force Calculations	979
3.7	Direct Calculation	980
3.9	Buckling Strength	982
3.11	Strength Assessment Criteria.....	983
5	Bottom Construction	986
5.1	General.....	986
5.3	Double Bottom.....	986
5.5	Inner Bottom Depth	986
5.7	Drain Wells	986
7	Side Construction.....	986
7.1	General.....	986
7.3	Shell Plating	986
7.5	Compensation	988
7.7	Sheerstrake.....	988
7.9	Frames	988
7.11	Web Frames and Stringers.....	993
7.13	Portlights	995
7.15	Gangway and Cargo Ports Located Below the Margin Line	995
7.17	Watertight and Watertight Integrity Above the Margin Line	996
9	Deck Construction.....	996
9.1	General.....	996
9.3	Deck Plating	996
9.5	Beams	998
11	Watertight Bulkheads and Doors	999
11.1	Application.....	999
11.3	Construction	999
11.5	Collision Bulkhead	1002
11.7	Afterpeak and Machinery Space Bulkheads.....	1002
11.9	Stern Tubes.....	1003
11.11	Openings and Penetrations	1003
11.13	Watertight Doors, Manholes and Access Openings	1004
11.15	Watertight Doors in Watertight Bulkheads.....	1004
11.17	Watertight Doors in Cargo Spaces	1004
11.19	Watertight Doors to Shaft Tunnels and within Propulsion Machinery Spaces	1004
11.21	Portable Plates in Machinery Spaces.....	1004
11.23	Miscellaneous.....	1005

13	Tank Bulkheads	1005
13.1	Application	1005
13.3	Arrangement.....	1005
13.5	Construction	1005
13.7	Drainage and Air Escape	1005
13.9	Testing.....	1005
13.11	Plating.....	1006
13.13	Stiffeners	1006
13.15	Girders and Webs.....	1007
13.17	Tank-top Plating.....	1008
15	Superstructure and Deck House Construction	1008
15.1	General.....	1008
15.3	Watertight Decks, Trunks, Tunnels, Duct Keels and Ventilators.....	1008
15.5	Support Structures.....	1008
15.7	Effective Lower Deck Thickness	1008
17	Rudders.....	1009
TABLE 1	Load Cases	981
TABLE 2	Limiting Failure Criteria	983
TABLE 3	Minimum Deck Loading	991
FIGURE 1	Inner Bottom Configuration	987
FIGURE 2	Unsupported Span of Longitudinal.....	992
FIGURE 3	Hold and Tween Deck Frames	994
FIGURE 4	Collision Bulkhead in Vessels with Bow Door.....	1003
FIGURE 5	Reference Point for Vessels with Bulbous Bow.....	1003

SECTION 3 Subdivision and Stability 1010

1	General	1010
1.1	1974 SOLAS Convention, as amended	1010
1.3	Passenger Ship Safety Certificate	1010
1.5	Subdivision and Stability Review by Administration.....	1010
1.7	Subdivision and Stability Review by ABS	1010
3	Criteria.....	1010
3.1	Intact Stability	1010
3.3	Subdivision and Damage Stability	1010
3.5	Subdivision Load Line.....	1010
3.7	Additional Subdivision Considerations.....	1011
5	Required Information	1011
5.1	Information to be Submitted for Review.....	1011
5.3	Plans to be Submitted.....	1011
7	Stability Information	1011
7.1	Inclining Experiment and Lightweight Survey	1011
7.3	Trim and Stability Booklet.....	1012
7.5	Onboard Computers for Stability Calculations	1013

9	Damage Control.....	1013
9.1	Damage Control Plans	1013
9.3	Review by ABS.....	1013
9.5	Guidance on Content	1013
11	Ballast	1013
11.1	Permanent Ballast	1013
11.3	Ballast Water Management	1014

SECTION 3 Appendix 1 – Onboard Computers for Stability Calculations 1015

1	General	1015
1.1	Scope	1015
1.3	Design	1015
3	Calculation Systems	1015
5	Types of Stability Software	1016
7	Functional Requirements	1016
7.1	Calculation Program	1016
7.3	Direct Damage Stability Calculations	1016
7.5	Warning	1016
7.7	Data Printout	1016
7.9	Date and Time	1016
7.11	Information of Program.....	1016
7.13	Units	1016
9	Acceptable Tolerances	1017
9.1	Calculation Program of the Approved Stability Information	1017
9.3	Independent Program for Assessment of Stability.....	1017
11	Approval Procedure	1018
11.1	Conditions of Approval of the Onboard Software for Stability Calculations.....	1018
11.3	General Approval (optional).....	1019
11.5	Specific Approval.....	1019
13	Operation Manual	1020
15	Installation Testing	1020
17	Other Requirements.....	1021

TABLE 1	Acceptable Tolerances	1018
---------	-----------------------------	------

SECTION 4 Structural Fire Protection 1022

1	General	1022
1.1	1974 SOLAS Convention, as amended.....	1022
1.3	Application.....	1022
1.5	Plans to be Submitted	1023
3	Materials of Construction	1023
3.1	Steel or Equivalent Material.....	1023
3.3	Aluminum Alloys.....	1023
3.5	In Crowns and Casings of Category A Machinery Spaces	1023

5	Construction and Arrangement	1023
5.1	Main Vertical Zones and Horizontal Zones	1023
5.3	Bulkheads within a Main Vertical Zone	1024
5.5	Categorization of Spaces.....	1025
5.7	Protection of Stairways and Elevators (Lifts) in Accommodations	1034
5.9	Openings in "A" Class Divisions.....	1035
5.11	Openings in "B" Class Divisions.....	1036
5.13	Windows and Side Scuttles	1037
5.15	Ventilation Systems	1037
5.17	Restricted Use of Combustible Materials.....	1041
5.19	Miscellaneous Items of Structural Fire Protection.....	1042
5.21	Special Arrangements for Machinery Space Openings	1043
5.23	Special Category Spaces	1043
7	Means of Escape	1046
7.1	General.....	1046
7.3	From Below the Bulkhead Deck	1046
7.5	From Above the Bulkhead Deck	1046
7.7	Stairways to Embarkation Deck.....	1047
7.9	Stairway Dimensions and Arrangements.....	1047
7.11	Protection of Access to Embarkation Areas.....	1047
7.13	Stairways Serving a Single Space and its Balcony.....	1047
7.15	Means of Escape from Public Spaces Spanning Three or More Decks	1047
7.17	Sole Means of Escape from Space Below the Bulkhead Deck	1048
7.19	Means of Escape from Radiotelegraph Station	1048
7.21	Means of Escape from Corridors and Lobbies.....	1048
7.23	Means of Escape from Machinery Spaces	1048
7.25	Means of Escape from Machinery Control Rooms.....	1048
7.27	Elevators (Lifts) Not to be Considered as Means of Escape.....	1048
TABLE 1	Bulkheads Not Bounding Either Main Vertical Zones or Horizontal Zones.....	1030
TABLE 2	Decks Not Forming Steps in Main Vertical Zones Nor Bounding Horizontal Zones.....	1031
TABLE 3	Fire Integrity of Bulkheads Separating Adjacent Spaces....	1032
TABLE 4	Fire Integrity of Decks Separating Adjacent Spaces	1033
FIGURE 1	Insulation of Stiffeners and Girders.....	1034
FIGURE 2	Insulation at Intersections Between Bulkheads, Decks, etc.	1034
FIGURE 3	Pipe Penetration of "A" Class Division (material: Steel, Copper, Al-alloy, PVC)	1044
FIGURE 4	Pipe Penetration of "B" Class Division (material: Steel, Copper, Al-alloy, PVC)	1045
FIGURE 5	Ventilation Duct Penetration of "A" Class Division (Bulkheads and Decks)	1045
FIGURE 6	Ventilation Duct Penetration of "B" Class Division (Bulkheads and Decks)	1046

SECTION 5	Machinery Equipment and Systems	1049
1	Classification of Machinery	1049
1.1	General.....	1049
1.3	Certification of Machinery	1050
1.5	Machinery Plans.....	1050
1.7	Miscellaneous Requirements for Machinery.....	1050
1.9	Sea Trials	1051
3	Prime Movers	1051
3.1	Diesel Engines, Turbochargers, Gas Turbines and Steam Turbines	1051
5	Propulsion and Maneuvering Machinery	1051
5.1	Gears, Propulsion Shafting, Propellers, and Thrusters	1051
5.3	Steering Gears	1051
5.5	Qualitative Failure Analysis for Propulsion and Steering on Passenger Ships	1052
7	Boilers, Pressure Vessels and Fired Equipment	1054
9	Deck and Other Machinery	1054
9.1	Anchor Windlass	1054
11	Piping Systems	1054
11.1	General.....	1054
11.3	Piping System Connections to the Shell.....	1054
11.5	Bilge Systems.....	1055
11.7	Damage Stability Consideration	1061
11.9	Air Pipes and Sounding	1061
11.11	Fuel Oil Storage	1061
11.13	Bulkhead Penetrations	1062
11.15	Flooding Detection System.....	1062
13	Electrical Systems.....	1062
13.1	General.....	1062
13.3	Main Source of Electrical Power.....	1062
13.5	Emergency Source of Electrical Power	1063
13.7	Electrical Cables in Accommodation Areas	1067
13.9	Manual Alarm System	1067
13.11	General and Special Fire Alarms.....	1067
13.13	General Emergency Alarm System	1067
13.15	Public Address System.....	1068
13.17	Escape Route or Low Location Lighting (LLL).....	1068
13.19	Supplementary Lighting.....	1069
15	Remote Propulsion Control and Automation	1069
15.1	General.....	1069
17	Watertight Doors	1069
17.1	Watertight Doors in Watertight Bulkheads.....	1069
17.3	Power-Operated Sliding Watertight Doors.....	1069
17.5	Central Operating Console	1072
19	Shipboard Elevators (Lifts).....	1072
19.1	General.....	1072
21	Helicopter Landing Areas.....	1072

23	Vibration Prediction Analysis and Measurement	1072
23.1	Prediction Analysis	1072
23.3	Measurement.....	1073
25	Passenger Ships of 120 M in Length or More or Having Three or More Main Vertical Zones.....	1073
25.1	Definitions.....	1073
25.3	Casualty Threshold, Safe Return to Port and Safe Areas.....	1073
25.5	Design Criteria for Systems to Remain Operational after a Fire Casualty	1074
25.7	Availability of Essential Systems in Case of Flooding Damage	1074
27	Safety Center	1075

TABLE 1	Standard Discharge Connection	1061
---------	-------------------------------------	------

SECTION 6 Fire Safety Systems 1076

1	General Provisions for Fire Safety Systems	1076
1.1	Fire Control Plans	1076
1.3	Remote Propulsion Control and Automation.....	1077
3	Provisions for Specific Spaces.....	1077
3.1	Machinery Spaces	1077
3.3	Accommodation and Service Spaces	1077
3.5	Miscellaneous High Risk Spaces.....	1078
5	Fire-extinguishing Systems and Equipment	1078
5.1	Fire-Main Systems.....	1078
5.3	Fixed Gas Fire Extinguishing Systems, Fixed Foam Fire Extinguishing Systems, and Fixed Pressure Water-Spraying and Water-mist Fire Extinguishing Systems in Machinery Spaces.....	1083
5.5	Fixed Fire Detection and Fire Alarm Systems, and Fixed Automatic Sprinkler, Fire Detection and Fire Alarm Systems	1083
5.7	Fixed Fire Detection and Fire Alarm Systems	1083
5.9	Automatic Sprinkler, Fire Detection and Fire Alarm Systems	1083
5.11	Central Control Station for Fire Detection Alarms	1084
5.13	Portable Fire Extinguishers and Portable Foam Applicators.....	1084
5.15	Fire-fighter's Outfit	1084
5.17	Emergency Escape Breathing Devices (EEBD)	1085
5.19	Marking of Fire Equipment Locations	1086
5.21	Control Arrangements for Doors in Fire Boundaries	1086
5.23	Power Ventilation Control Systems.....	1088
5.25	Portable Communication Equipment	1088

TABLE 1	Dimensions of International Shore Connection	1082
---------	--	------

SECTION 7	Additional Notations	1089
1	Environmental Protection Notations	1089
3	Passenger and Crew Comfort Notations	1089
3.1	Passenger Comfort	1089
3.3	Crew Comfort	1089
5	Propulsion Redundancy Notations	1090
5.1	General.....	1090
7	Availability of Guides.....	1090
APPENDIX 1	IMO Guidance for Structural Fire Protection	1091
APPENDIX 2	International Standards for Windows.....	1092

PART 5C

CHAPTER 7 Vessels Intended to Carry Passengers

SECTION 1 Introduction

1 General

1.1 Classification

In accordance with 1-1-3/3 of the *ABS Rules for Conditions of Classification (Part 1)*, the classification **✕ A1 Passenger Vessel** is to be assigned to vessels designed and specifically fitted for the carriage of passengers and built to the requirements of this Chapter and relevant sections of the Rules.

In addition to the above, the vessel is to have a Passenger Ship Safety Certificate from the Administration of registry or its agent evidencing the vessel's compliance with the requirements of the International Convention for the Safety of Life at Sea 1974, as amended.

1.3 Application

These requirements are intended to apply to passenger vessels (i.e., vessels carrying more than twelve (12) passengers on international voyages or on short international voyages).

In the case of a passenger vessel which is employed in special trades for the carriage of large numbers of special trade passengers, such as the pilgrim trade, the requirements will be given special consideration, taking into account the following:

- The rules annexed to the International Conference on Special Trade Passenger Ships, 1971 and;
- The rules annexed to the International Conference on Space Requirements for Special Trade Passenger Ships, 1973.

The Requirements in this Chapter are applicable to vessels of 61 m (200 ft) and over in length intended for unrestricted ocean service. Passenger vessels of lesser size will be given special consideration.

1.5 Scope

This Chapter is intended to cover the additional hull construction, machinery and safety equipment requirements to class a vessel as a passenger vessel, not contained elsewhere in the Rules.

These requirements are applicable to those features that are permanent in nature and can be verified by plan review, calculation, physical survey or any other means.

This Chapter is intended for passenger vessels to be used exclusively for the transportation and entertainment of their passengers and, accordingly, does not address requirements associated with transportation of cargo and vehicles.

This Chapter does not address the requirements from the 1974 SOLAS Convention, as amended, for operational instructions, Life-Saving Appliances and Arrangements (Chapter III), Radiotelegraphy and Radiotelephony (Chapter IV) and Safety of Navigation (Chapter V), which may be found in the Convention.

1.7 Passenger Ship Safety Certificate

Where authorized by the Administration of a country signatory to the International Convention for the Safety of Life at Sea, 1974, as amended, and upon request of the Owner of a classed vessel or one intended to be classed, ABS will review the plans, data, etc., and survey the vessel for compliance with the provisions of the 1974 SOLAS Convention, as amended, and issue a Passenger Ship Safety Certificate prescribed in the Convention on behalf of the Administration.

1.9 Independent Review

When the Passenger Ship Safety Certificate is issued by an Administration or its agent other than ABS, ABS when requested, will conduct an independent review of any of the following:

Subdivision and Stability	Damage Control Plan
Trim and Stability Booklet	Life-Saving Appliances and Arrangements
Inclining Experiment	Safety of Navigation
Structural Fire Protection	Fire Control Plan

Fees for such independent reviews will be charged to the owner when the review is requested.

1.11 Administration Approval

In general, the approval of material, safety equipment, lifesaving appliances, etc., is a function of the Administration. When the Administration or its agent, other than ABS, issues a Passenger Ship Safety Certificate to the vessel, such certificate will be accepted as evidence that the Administration has approved the material, safety equipment, life-saving appliances, etc.

With other passenger vessels, the designer or builder will submit evidence that the Administration has approved the material, safety equipment, lifesaving, etc., for ABS's acceptance on vessels building to class.

When given specific instructions from the Administration, ABS may approve and accept the material, equipment, life-saving appliances, etc., fitted on the vessel.

3 Definitions

3.1 General

For definitions of terms used in this Chapter and not shown below, reference is to be made to the definitions in Chapters II-1 and II-2 of the International Convention for the Safety of Life at Sea, 1974, as amended. (abbreviated: 1974 SOLAS Convention, as amended).

3.3 "A" Class Division

"A" class divisions are those divisions formed by bulkheads and decks which are constructed of steel or other equivalent material, are suitably stiffened, are so constructed as to be capable of preventing the passage of smoke and flame to the end of the one-hour standard fire test prescribed in II-2/3.2 of the 1974 SOLAS Convention, as amended, and are insulated with approved non-combustible materials so that the average temperature rise of the unexposed side or any one point, including any joint, does not exceed the temperature limits prescribed in II-2/3.3 of the Convention.

3.5 Accommodation Spaces

Accommodation Spaces are those spaces used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, games and hobbies rooms, barber shops, pantries containing no cooking appliances and similar spaces.

3.7 Administration

Administration means the Government of the State whose flag the vessel is entitled to fly.

3.9 "B" Class Division

"B" class divisions are those divisions formed by bulkheads, decks, ceilings or linings which are so constructed as to be capable of preventing the passage of flame to the end of the first half hour of the standard fire test, have an insulation value such that the average temperature of the unexposed side or any one point, including any joint, does not rise more than the limits prescribed in II-2/3.4 of the 1974 SOLAS Convention, as amended, are constructed of approved non-combustible materials and all materials entering into the construction and erection of "B" class divisions are non-combustible, with the exception that combustible veneers may be permitted if other applicable requirements of Section 5C-7-4 are met.

3.11 Breadth

Breadth, in general, is the greatest molded width of the vessel in meters (feet). For the application of Section 5C-7-3, *breadth* is defined as the greatest molded width of the vessel at or below the deepest subdivision load line.

3.13 Bulkhead Deck

The *Bulkhead Deck* is the highest deck to which the watertight bulkheads extend and are made effective.

3.15 "C" Class Division

"C" *class divisions* are divisions constructed with approved non-combustible materials. These are no requirements pertaining to the passage of smoke or flame or to temperature rise. Combustible veneers are permitted provided the other applicable requirements of Section 5C-7-4 are met.

3.17 Deepest Subdivision Load Line

Deepest Subdivision Load Line is the waterline that corresponds to the greatest draft permitted by the subdivision requirements that are applicable.

3.19 Draft

Draft, in general, is the distance in meters (feet) from the molded base line to the deepest subdivision load line. *Draft* for the application of Section 5C-7-3 is defined as the vertical distance from the molded base line amidships to the subdivision load line in question.

3.21 Effective Superstructures and Deckhouses

An *effective superstructure* or *effective deckhouse* is one that exceeds $0.14L$ in length and lies within $0.5L$ amidships.

3.23 Fire Test Procedures Code (1 July 2014)

Fire Test Procedures Code is the International Code for Application of Fire Test Procedures, as adopted by IMO Resolution MSC.307(88), as may be amended by IMO.

3.25 Length

Length, in general, is defined in 3-1-1/3 of the Rules. For the application of Section 5C-7-3, *Length* is defined as the measured distance in meters (feet) between perpendiculars taken at the extremities of the deepest subdivision load line.

3.27 Machinery Spaces

Machinery Spaces are all machinery spaces of category A and all other spaces containing propulsion machinery, boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilation and air-conditioning machinery, and similar spaces, and trunks to such spaces.

3.29 Machinery Spaces of Category A

Machinery Spaces of Category A are those spaces and trunks to such spaces which contain internal combustion machinery used for main propulsion, or internal combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of not less than 375 kW (500 hp), or any oil-fired boiler or oil fuel unit.

3.31 Margin Line

The *Margin Line* is a line drawn at least 76 mm (3 in.) below the upper surface of the bulkhead deck at side.

3.33 Passenger

A *Passenger* is every person other than the master and the members of the crew or other persons employed or engaged in any capacity on board a vessel on the business of that vessel and children under one year of age.

3.35 Passenger Spaces

Passenger Spaces are those spaces provided for the accommodation and the use of passengers, excluding baggage, store, provision and mail rooms. For the purposes of Regulations II-1/6, II-1/7, II-1/7-1, II-1/7-2, and II-1/7-3, spaces provided below the margin line for the accommodation and the use of the crew shall be regarded as passenger spaces.

3.37 Public Spaces

Public Spaces are those portions of the accommodation used for halls, dining rooms, lounges and similar permanently enclosed spaces.

3.39 Regulations

Regulations means the regulations contained in the International Convention for the Safety of Life at Sea, 1974, as amended. The abbreviated notation form is used (e.g., "Regulation II-2/4.5.5.2" means "Regulation 4.5.5.2 of Chapter II-2").

3.41 Service Spaces

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

3.43 Short International Voyage

Short International Voyage is an international voyage in the course of which the vessel is not more than 200 nautical miles from a port or place in which the passengers and crew could be disembarked in safety. Neither the distance between the final port of destination and the last port of call in the country in which the voyage began, nor the return voyage, shall exceed 600 nautical miles. The final port of destination is the last port of call in the scheduled voyage at which the vessel commences its return voyage to the country in which the voyage began.

3.45 Special Category Spaces

Special Category Spaces are those enclosed spaces above or below the bulkhead deck intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion, into and from which such vehicles can be driven and to which passengers have access.

3.47 Steel or Other Equivalent Material

Steel or other equivalent material means steel and any non-combustible material which, by itself or due to insulation provided, has structural and integrity properties equivalent to steel at the end of the applicable exposure to a standard fire test conducted in accordance with the Fire Test Procedures Code. (e.g., aluminum alloy with appropriate insulation).

3.49 Strength Deck

Strength Deck is the uppermost deck to which the side shell extends.

3.51 Subdivision Load Line

Subdivision load line is a waterline used in determining the subdivision of the vessel.

PART 5C

CHAPTER 7 Vessels Intended to Carry Passengers

SECTION 2 Hull Structure

1 General

1.1 General Structural Requirements

The hull structure requirements in this Chapter are intended for passenger vessels of welded construction using steels complying with the requirements of Chapter 1 of the *ABS Rules for Materials and Welding (Part 2)*. The use in hull structures of steels other than those in Chapter 1 of the above referenced Part 2 and of aluminum alloys will be considered upon submission of the specification of the materials and the proposed method of fabrication.

Refer to Section 3-1-2 of the Rules for general requirements pertaining to the selection of materials, fabrication, determination of required scantlings and structural design details.

1.3 Structural Sections

The scantling requirements of this Chapter are applicable to plating, structural angles, channels, bars, and rolled, or built-up, sections.

1.3.1 Deep Supporting Members

The required *SM* of members such as girders, webs, etc., supporting frames, beams and stiffeners, is to be obtained assuming an effective width of attached plating in accordance with this Subparagraph. The section is to include the structural member in association with an effective width of plating not exceeding one-half of the sum of the spacing on each side of the member, or 33% of the span ℓ , whichever is less. For girders and transverses along hatch openings, an effective breadth of plating not exceed one-half of the spacing or 16.5% of the unsupported span ℓ , whichever is less, is to be used.

1.3.2 Frames, Beams and Other Stiffeners

1.3.2(a) Section Modulus. The required *SM* is to be provided by the stiffener and a maximum of one frame space of plating to which it is attached.

1.3.2(b) Web Thickness. The depth to thickness ratio 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	for horizontal web within a tank
	=	1.0	for all other cases
C_2	=	1.0	for ordinary strength steel
	=	0.92	for HT 32 strength steel
	=	0.9	for HT 36 strength steel

1.5 Required Structural Drawings

Plans showing the scantlings, arrangements and details of the principal parts of the hull structure of each vessel to be built under survey are to be submitted and approved before the work of construction is commenced. Refer to Section 1-1-7 of the *ABS Rules for Conditions of Classification (Part 1)* for a list of hull plans to be submitted for review or reference.

Where statutory certification in accordance with Section 1-1-5 of the *ABS Rules for Conditions of Classification (Part 1)* is requested, the submission of additional plans and calculations may be required.

3 Longitudinal Strength

3.1 General

The longitudinal strength of passenger vessels is to be in accordance with Section 3-2-1 of the Rules and with the additional requirements of this section.

The superstructure and deckhouses, where effective, are to satisfy the hull girder section modulus requirements.

Special attention, during the design stage, is to be given to the structural arrangement to verify that the longitudinal and transverse bulkhead plating within effective superstructures and deckhouses and the deck house side plating is efficiently integrated into the hull structure.

The longitudinal and transverse hull girder strength is to be assessed by direct calculation (see 5C-7-2/3.7) for passenger vessels 150 m (492 ft) or more in length to be classed for unrestricted service or where the deckhouse structure is considered effective and included in the hull girder section modulus calculation.

3.3 Calculation of Hull Girder Section Modulus

All continuous longitudinal structural material is to be included in the calculation of the hull girder section modulus.

The section modulus to the bottom, SM_b , is obtained by dividing the moment of inertia, I , by the distance from the neutral axis to the molded base line.

The section modulus to the top, SM_t , is obtained by dividing the moment of inertia, I , by the distance from the neutral axis to the molded line of the strength deck at side except that, where an effective superstructure or deckhouse is fitted, the distance is to be measured from the neutral axis to the molded line of the deck forming the top of the effective superstructure or deckhouse.

3.5 Bending Moment and Shear Force Calculations

3.5.1 Still Water Bending Moment and Shear Force

Still water bending moment and shear force calculations are to be submitted for passenger vessels classed for unrestricted service and for all passenger vessels having a length L of 122 m (400 ft) or more. These calculations are to be carried out for all anticipated loaded and ballast conditions. The distribution of lightship weight is also to be shown.

3.5.2 Wave Induced Bending Moment and Shear Force

The wave induced bending moment and shear force distribution in 3-2-1/3.5 of the Rules is to be applied for passenger vessels classed for unrestricted service. When determining the wave induced bending moments and shear forces, the block coefficient C_b is not to be taken less than 0.60.

3.5.3 Bowflare Slamming Effect on Vertical Hull-Girder Bending Moment and Shear Force

Where the bow lines feature large bow flare angles, consideration shall be given to increase the sagging wave bending moment using the approach for container ships in 5C-5-3/11.3.3 of the Rules, for assessing the longitudinal strength in the sagging condition. Optionally, the magnitude and location of the increase in the wave sagging bending moment and shear force is to be determined using a slamming prediction program.

3.5.4 Total Bending Moment

Where the calculations indicate that the vessel is under hogging condition in all still water loading conditions, the total bending moment, M_t , is to be taken as not less than $0.9M_{ws}$ in the calculations of the buckling strength of the structural members above the neutral axis. Special consideration may be given to the minimum M_t under the conditions given in 3-2-1/19 of the Rules.

3.7 Direct Calculation

3.7.1 General

The scantlings, arrangements and strength characteristics of the material are to be confirmed by a 3-D finite element analysis of the entire vessel, including the superstructure and deckhouses, to determine the overall structural response in still water and in wave conditions. The adequacy of the hull structure is to be evaluated for the vessel for both the worst hogging and worst sagging load conditions.

3.7.2 Global FE Model

A 3-D plate element model is to be developed for the entire vessel length and full depth to the superstructure deck-house top including all effective longitudinal material and all transverse primary structure, including watertight and fire division bulkheads.

The size and type of plate elements selected are to provide satisfactory representation and stress distributions within the vessel's structure. The plate element mesh size is to follow the span and spacing arrangement of the primary structural members. Longitudinally, there is to be at least one element between the primary transverse members and one element between decks and sufficient elements transversely to maintain a satisfactory panel aspect ratio.

All primary plate structure such as deck plating, bottom and side shell plating, longitudinal and transverse bulkhead plating, transverse floors and longitudinal bottom girders, superstructure and deckhouse side plating are to be represented by plate or membrane elements, as appropriate. Longitudinal deck girders and transverses, and side shell, superstructure and deckhouse framing are to be represented by line elements having axial and bending stiffness. Secondary stiffening is to be represented by line elements grouped at plate boundaries. Pillars are to be represented by line elements having axial and bending stiffness.

All deck openings and all shell openings including those for windows and doors etc., of a significant size are to be represented and modeled in the global model such that the deformation shape and maximum deflection under the hull shear and bending loads is adequately represented. Any idealization of these large openings is to be verified by means of check FE models and comparison with suitable fine mesh models.

Any other significant features such as large side sweeps, side screens/fairing plates, trunks and casings are to be modeled.

3.7.3 Loads

Still water bending moment and shear force calculations for the worst hogging condition and the worst sagging condition (or minimum hogging condition) are to be submitted for review. The vessel's lightship block weight distribution, hydrostatic tables, capacity plan and the preliminary trim and stability conditions corresponding to the submitted still water bending moment and shear force calculations are to be submitted for reference.

The wave loads used are to be determined from ship motion analysis, based on North Atlantic Ocean conditions for unrestricted service. The calculated long-term extreme vertical wave bending moment/shear force value is to be based on the wave data for a probability level of 10^{-8} representative of a 20-year period. The maximum vertical wave bending moments and shear forces obtained from the long-term response analysis are not to be lower than the requirement in 3-2-1/3.5 of the Rules, for a vessel classed for unrestricted services.

Where direct calculation of the wave-induced loads is not available, the approximation equations specified in 5C-5-3/5 of the Rules may be used to calculate the design loads.

One additional load case, representing maximum racking conditions from beam seas, (heading angle of 90°), under realistic deck loads and ship-loading condition, is to be calculated. The deck loads due to static forces on a roll angle of 30° are to be used and the vessel is to be balanced in still water in the heeled condition.

Aft-end bottom slamming and bow flare slamming and other loads are also to be considered as necessary.

3.7.4 Combined Load Cases

The strength adequacy of the global structure is to be evaluated for the load cases given in 5C-7-2/Table 1:

TABLE 1
Load Cases

Load Cases	
1	Still water (worst hogging condition)
2	Still water (worst sagging or min. hogging)
3	Max. wave hogging (max. hogging still water + max. wave hogging) *
4	Max. wave sagging (min. hogging still water + max. wave sagging) *
5	Max. racking load for the worst hogging condition
6	Max. racking load for the worst sagging condition
* See 5C-7-2/3.5.4	

3.7.5 Global Model Constraints

For the still water, wave and racking load cases the model is to be free of imposed constraints except for those necessary to prevent rigid body motion. Rigid body motions may be prevented by the use of free-body constraint (i.e., inertia relief supports).

3.7.6 2-D Fine Mesh FE Models

Based on the results of the 3-D Global FE analysis, additional fine mesh models are to be developed for highly stressed areas and other areas of concern. In the fine mesh analyses, boundary forces or boundary displacements obtained from the 3-D coarse mesh global analysis are to be used as boundary conditions. In addition to the boundary constraints, all local loads are to be applied to the fine mesh models.

As a minimum, the following fine mesh FE models are to be developed and analyzed in order to determine the extent of reinforcement, if necessary:

- Bulkhead door openings
- Engine room casing
- Large upper deck openings
- Longitudinal bulkheads above theaters and dining halls
- Multi-deck atriums
- Openings in webs of longitudinal girders and in webs of transverse deck beams and girders
- Shell doors
- Side screens/fashion plates
- Sweeps
- Window openings

The fine mesh FE models are to include the window and doorframes if welded to the plating, and the plate stiffeners as line beam elements.

3.7.7 3-D Refined FE Model

3-D refined FE models of the primary deck support members (i.e., girders and transverses) including attached deck plating and secondary members between adjacent primary members, are to be submitted for review. The size and geometry of all service openings in the web plating, including openings for the passage of longitudinals, are to be modeled. The mesh density is to provide a minimum of 12 elements in the web depth. The Rule deck load or design deck load is to be applied as a pressure uniformly distributed over the deck. For the analysis of the deck girders, the appropriate hull girder direct stress due to global bending is to be included together with the secondary loading.

Consideration is to be given to modeling the load component and the support from pillars in way of highly loaded pillar supports.

3.7.8 Transverse Frame FE Analysis

The strength adequacy of the Midship Section in way of pillar columns modeled up to the highest upper deck and any other critical section (e.g., in way of the Engine Room) is to be assessed using a fine mesh FE model. Deck transverse service openings are to be modeled as well as the slots for longitudinals through side shell framing and slots for bottom and inner bottom longitudinals in transverse floors. The deck loads and side pressure are to be applied as line load and the loads are to be balanced by applying the proper longitudinal shear forces at key master nodes (i.e., longitudinal girders, side shell etc.). Alternatively, displacements from the Global FE Model response may be applied to the detailed 2-D model as boundary conditions.

Two load cases are to be evaluated, maximum wave hogging and maximum wave sagging (i.e., no oblique seas).

3.7.9 Stress Results

The following results (plots) are to be submitted for review:

- Deformed shapes
- Direct primary in-plane stresses in local x and y directions
- Von-Mises stress
- In-plane shear stress
- Beam/bar maximum combined stresses
- Axial load and stress in pillars

Tables providing the stress components for the most highly stressed elements are to be provided for comparison with the stress assessment criteria. Tables of loads and stresses are also to be provided for all pillars for comparison with the critical buckling stress.

3.9 Buckling Strength

3.9.1 General

Shell, strength deck and other effective decks together with their stiffening members are to have sufficient strength to withstand the compressive and shear loads due to the maximum bending moment. Non-effective decks, which are subject to compression due to hull girder bending, are to have stiffening members of sufficient strength to withstand the compression under the above bending moment.

3.9.2 Uppermost Continuous Decks and Longitudinal Bulkheads

Where the still water bending moment, in any loading condition, is in a hogging mode, the maximum total sagging moment for assessing the buckling strength of the uppermost continuous decks and longitudinal bulkheads, is to be calculated from a seakeeping analysis using a speed of advance equal to one half the design speed or 8 knots, whichever is the greater, in deriving the maximum equivalent long-term wave sagging moment. Alternatively, the maximum sagging bending moment may be calculated by balancing statically, the vessel in the minimum still water hogging condition on an equivalent sagging wave having a maximum wave height equal to $0.6\sqrt{L}$ m ($1.087\sqrt{L}$ ft) and a corresponding wave length equal to the scantling length, L . See also 5C-7-2/3.5.4.

3.9.3 Bottom and Bilge

The buckling strength of the bottom and bilge plating, bottom girders, inner bottom and margin plate, deep tank longitudinal bulkheads, effective decks, deck house side plating and longitudinal bulkheads are to be assessed in accordance with the Rules, Appendix 3-2-A4. Net thickness of plating in mm (in.), after making standard deductions as given in the Rules 3-2-A4/Table 1, is to be used for assessing the buckling strength.

3.11 Strength Assessment Criteria

3.11.1 Yielding Criteria

When assessing the adequacy of the global hull girder strength and the individual structural members or element the limiting failure criteria given in 5C-7-2/Table 2 shall be used.

3.11.2 Buckling Criteria

All longitudinal structural members subject to hull girder bending, whether or not they are included in the calculations of the hull girder section modulus, are to have their buckling strength assessed under 3-2-1/19 or 5C-5-5/5 of the Rules. The net plate thickness, as defined above, is to be used for assessing the buckling strength of decks, bottom and side shell, double bottom structure and longitudinal and transverse bulkheads.

TABLE 2
Limiting Failure Criteria

<i>Limiting Stress Criteria</i>	<i>kN/cm² (tf/cm², Ltf/in²)</i>
A) Global Model	
<i>Longitudinal Members</i>	
Von-Mises stress	$\leq 22.3/Q$ (2.274/Q, 14.44/Q)
Combined in-plane stress (hull girder + girder bending)	$\leq 19.0/Q$ (1.937/Q, 12.30/Q)
Primary hull girder in-plane stress	$\leq 17.5/Q$ (1.784/Q, 11.33/Q)
In-plane shear stress	$\leq 11.0/Q$ (1.121/Q, 7.12/Q)
Pillars (Tension)	$\leq 11.0/Q$ (1.121/Q, 7.12/Q)
<i>Transverse members</i>	
Von-Mises stress	$\leq 18.0/Q$ (1.835/Q, 11.65/Q)
In-plane bending stress	$\leq 16.0/Q$ (1.631/Q, 10.36/Q)
In-plane shear stress	$\leq 9.0/Q$ (0.918/Q, 5.83/Q)
B) 2-D Fine Mesh Models	
Average Von-Mises in mid-plate field or between openings	$\leq 22.3/Q$ (2.274/Q, 14.44/Q)
Direct (Normal) stress	$\leq 19.0/Q$ (1.937/Q, 12.30/Q)
In-plane shear stress	$\leq 11.0/Q$ (1.121/Q, 7.12/Q)
Direct Tangential Peak Stress	$\leq 1.5 f_y$
C) 3-D fine Mesh Models	
<i>Longitudinal Members</i> (Including Global primary stress)	
Von-Mises stress	$\leq 22.3/Q$ (2.274/Q, 14.44/Q)
In-plane bending stress	$\leq 19.0/Q$ (1.937/Q, 12.30/Q)
In-plane shear stress	$\leq 11.0/Q$ (1.121/Q, 7.12/Q)
Direct Tangential Peak Stress	$\leq 1.5 f_y$

TABLE 2 (continued)
Limiting Failure Criteria

Limiting Stress Criteria	kN/cm ² (tf/cm ² , Ltf/in ²)
Transverse & Girder Members (Local secondary stress)	
Von-Mises stress	≤ 18.0/Q (1.835/Q, 11.65/Q)
In-plane bending stress	≤ 13.9/Q (1.417/Q, 9.00/Q)
In-plane shear stress	≤ 9.0/Q (0.918/Q, 5.83/Q)
Direct Tangential Peak Stress	≤ 1.5 f_y
Notes: Q = material conversion factor f_y = minimum specified yield point of the material in = 1.0 for ordinary strength steel kN/cm ² (tf/cm ² , Ltf/in ²) = 0.78 for H32 strength steel = 0.72 for H36 strength steel = 0.68 for H40 strength steel	

Plate panels subject to high in-plane compressive and shear stresses are to have their buckling strength assessed under 3-2-1/19 or 5C-5-5/5 of the Rules and meet the following interaction limiting equation:

$$(f_L/R_\ell f_{cL})^2 + (f_T/R_t f_{cT})^2 + (f_{LT}/f_{cLT})^2 \leq 1.0 \quad \text{or, if more stringent,}$$

$$(f_L/R_\ell f_{cL})^2 + (f_{LT}/f_{cLT})^2 \leq 1.0$$

where

f_L = calculated total compressive stress in the longitudinal direction for the plate, in N/cm² (kgf/cm², lbf/in²), induced by bending and torsion of the hull girder and large stiffened panels between bulkheads

f_T = calculated total compressive stress in the transverse/vertical direction, in N/cm² (kgf/cm², lbf/in²)

f_{LT} = calculated total shear stresses in the horizontal/vertical plane, in N/cm² (kgf/cm², lbf/in²)

f_{cL}, f_{cT}, f_{cLT} = the critical buckling stresses corresponding to uniaxial compression in the longitudinal, transverse/vertical direction and edge shear, respectively, in N/cm² (kgf/cm², lbf/in²), and may be determined from the equations given in Appendix 5C-5-A2 of the Rules.

R_ℓ, R_t = reduction factors accounting for lateral load effects, and may be approximated by:

R_ℓ = 1.0 for plating longitudinally stiffened.

R_t = $1.0 - 0.45(q^{1/2} - 0.71)$ for plating longitudinally stiffened

R_t = 1.0 for plating transversely stiffened.

R_ℓ = $1.0 - 0.45(q^{1/2} - 0.71)$, for plating transversely stiffened.

R_ℓ, R_t are not to be taken less than 0.50.

q = lateral load parameter

= $p_n(s/t_n)^4/\pi^2 E$ but is not to be taken less than 0.50

p_n = net lateral pressure for the combined load cases considered (see 5C-5-3/9.3.1(b) of the Rules), in N/cm² (kgf/cm², lbf/in²)

s = stiffener spacing, in mm (in.)

t_n = net thickness of the plate, in mm (in.)

E = Young's modulus of elasticity

= for steel, 20.6×10^6 N/cm² (21.0×10^5 kgf/cm², 30.0×10^6 lbf/in²)

f_L , f_T , f_{LT} are to be determined for the critical combined load cases specified in 5C-5-3/9.3 of the Rules, including the primary and secondary stresses as defined in 5C-5-3/3.3 of the Rules.

f_L , f_T may be taken as zero when they are in tension.

The stiffness and proportions of longitudinal stiffeners and supporting structure are to meet the requirements of the Rules, Appendix 5C-5-A2/11 and are also to satisfy the following additional proportion limits:

$$b_f/t_w \leq 30$$

$$\ell/r \leq 2.5 \sqrt{E/f_y} \quad \text{for upper effective decks and bottom structure}$$

$$\ell/b_f \leq \sqrt{E/f_y} \quad \text{for fabricated stiffeners and girders}$$

where

b_f = total width of the flange/face plate, in cm (in.)

t_w = net thickness of the web, in cm (in.)

ℓ = unsupported span of the longitudinal or stiffener, in cm (in.), as defined in 5C-5-4/Figure 8 of the Rules

r = least radius of gyration of the longitudinal stiffener, including the effective plating, in cm (in.)

E = Young's modulus of elasticity

= for steel, 20.6×10^6 N/cm² (21.0×10^5 kgf/cm², 30.0×10^6 lbf/in²)

f_y = minimum specified yield point of the material in N/cm² (kgf/cm², lbf/in²)

3.11.3 Fatigue Criteria

For structural details in way of radius corners at locations such as sweeps, side screens or major shell and deck openings and at radius corners in way of windows, doors and other minor openings, the total applied stress range for these structural details is to be checked against the permissible stress range given below:

Structure Location	Allowable Stress Range		
	kN/cm ²	tf/cm ²	Ltf/in ²
Radius corners at sweeps, side screens or major shell and deck openings	51.0 c_f	5.200 c_f	33.02 c_f
Radius corners between windows, doors and other minor openings	60.0 c_f	6.118 c_f	38.85 c_f
Notes:			
	c_f	=	critical factor related to the details considered
		=	1.0 for free edges, free from welding
		=	0.7 for heavy window frame welded to shell (no free weld edge)
		=	0.375 for attachments to shell plating having weld endings

The working stress range is obtained as follows:

Stress Range = (max. primary hogging in-plane wave vertical bending stress – max. sagging in-plane wave vertical bending stress).

5 Bottom Construction

5.1 General

The bottom structure is in general to be in accordance with Section 3-2-4 of the Rules and with the following.

5.3 Double Bottom

A double bottom is to be fitted, in accordance with Section 3-2-4 of the Rules, extending from the forepeak bulkhead to the afterpeak bulkhead, or as near thereto as practicable. For vessels between 61 m (200 ft) and 76 m (250 ft) in length, a double bottom may be omitted in the machinery space. A double bottom need not be fitted in way of deep tanks of moderate volume provided the safety of the vessel is not thereby impaired in the event of bottom or side damage.

5.5 Inner Bottom Depth

Where a double bottom as required by 5C-7-2/5.3 is fitted, its depth in m (ft) is to be not less than the following:

$$d_{DB} = 32B \times 10^{-3} + c\sqrt{d} \quad \text{m (ft)} \quad \text{for } L \leq 427 \text{ m (1400 ft)}$$

where

d_{DB} = depth of double bottom, in m (ft)

c = 0.19 (0.344)

d = molded draft of vessel, in m (ft)

B = breadth of vessel, in m (ft)

L = scantling length of vessel, in m (ft)

The inner bottom is to be continued out to the vessel's sides in such a manner as to protect the bottom to the turn of bilge. Such protection will be deemed satisfactory if the line of intersection of the outer edge of the margin plate with the bilge plating is not lower at any point than a horizontal plane passing through the point of intersection with the frame line amidships, of a transverse diagonal line inclined at 25° to the base line and cutting it at a point one-half of the vessel's molded breadth from the centerline (see 5C-7-2/Figure 1).

5.7 Drain Wells

Drain wells constructed in the double bottom in conjunction with drainage arrangements of holds, etc., are not to extend downward more than necessary. The depth of the wells are not to exceed the depth of the double bottom at the centerline less 460 mm (18 in.), and the well is not to extend below the horizontal plane referred to in 5C-7-2/5.5. A drain well extending below the horizontal plane is, however, permitted at the after end of the shaft tunnel. Other well arrangements (e.g., for lubricating oil under main engines) will be considered provided they give protection equivalent to that afforded by the double bottom.

7 Side Construction

7.1 General

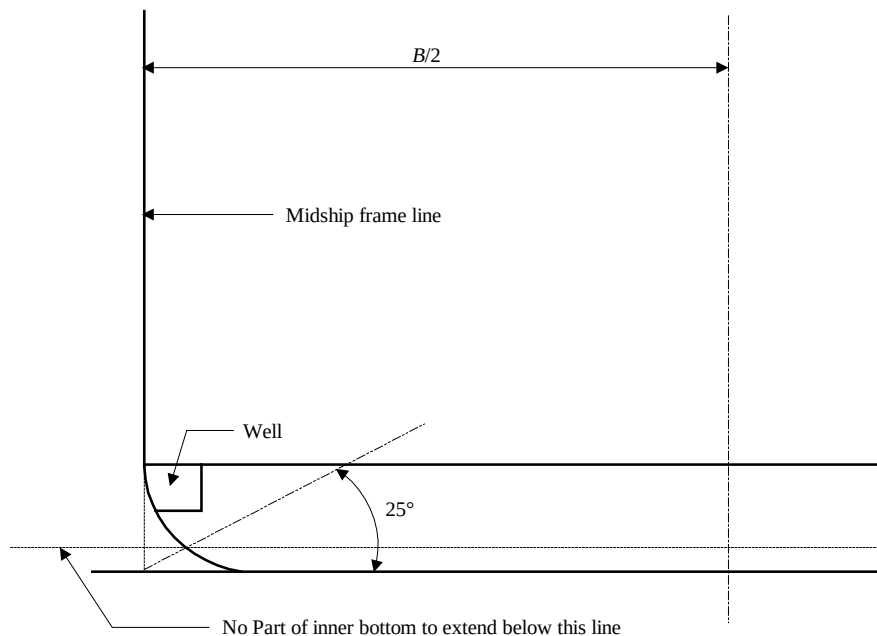
The side shell plating and framing are generally to be in accordance with the Rules, Sections 3-2-2 for plating, 3-2-5 for framing, 3-2-6 for web frames and side stringers and 3-2-11 for superstructures, deck-houses and helicopter decks and with the following.

7.3 Shell Plating

Side shell plating below the freeboard deck throughout $0.4L$ amidships, is to be in accordance with the Rules, Section 3-2-2 where D_s is the molded depth measured to the strength deck.

Side shell plating between the freeboard deck and 2.3m (7.5 ft) above the freeboard deck is to be in accordance with the Rules, 3-2-2/3.9 except that the reference to a minimum thickness, obtained by 3-2-2/5.1 of the Rules in association with frame spacing of 610 mm (24 in.), is not applicable. At the ends, the plating forward of $0.1L$ from the FP may be of the thickness obtained from 3-2-2/5.7 of the Rules and the plating aft of $0.1L$ from the AP may be of the thickness obtained from 3-2-2/5.9 of the Rules.

FIGURE 1
Inner Bottom Configuration



Side shell plating located at a distance greater than 2.3 m (7.5 ft) above the freeboard deck is to be not less than given by the following equation, except that forward of $0.25L$ from the FP the thickness need not exceed the requirement for forecastle side plating in 3-2-2/5.7 of the Rules, and aft of $0.25L$ from the AP the thickness need not exceed the requirement for poop side plating in 3-2-2/5.9 of the Rules.

$$t = 15.5 s \times 10^{-4} \sqrt{(L - 15.24)(d / D_s)} + 1.5 \text{ mm} \quad \text{for } L \leq 305 \text{ m}$$

$$t = 12.1 s \times 10^{-4} \sqrt{(L + 175)(d / D_s)} + 1.5 \text{ mm} \quad \text{for } 305 < L \leq 427 \text{ m}$$

$$t = 85.6 s \times 10^{-5} \sqrt{(L - 50)(d / D_s)} + 0.06 \text{ in.} \quad \text{for } L \leq 1000 \text{ ft}$$

$$t = 66.8 s \times 10^{-5} \sqrt{(L + 574)(d / D_s)} + 0.06 \text{ in.} \quad \text{for } 1000 < L \leq 1400 \text{ ft}$$

where

- s = spacing of transverse frames or longitudinals, in mm (in.)
- L = scantling length of vessel, in m (ft)
- d = molded draft of vessel, in m (ft)
- D_s = is the molded depth measured to the strength deck, in m (ft)

The actual ratio of d/D_s is to be used in the above equations except that the ratio is not to be taken less than $43L \times 10^{-3}/D_s$.

7.5 Compensation

Where large openings for passenger gangway access ports, stores and baggage ports, etc., are located in the side shell, they are to be kept well clear of discontinuities in the hull girder such as superstructure breaks. Where large ports are located in high shear areas such as those within $0.2 - 0.3L$ and $0.7 - 0.85L$ from the AP, insert plates are to be provided. The inserts are to be of Class III material (see 3-1-2/Table 1 of the Rules) and are to have large radius corners. The corner radii are to be equal to 10% of the opening width, but need not exceed a radius of 460 mm (18 in.). The thickness of inserts is to be confirmed by direct calculations.

Where it is proposed to fit port-lights in the shell plating, the locations and sizes are to be clearly indicated on the midship-section drawing when first submitted for approval. Details of doorframes and welding details are to be submitted for review.

Doors and openings are to meet the requirements of the Rules, Section 3-2-16 as applicable.

7.7 Sheerstrake

The minimum width, b , of the sheerstrake in m (ft), throughout the amidship $0.4L$ is to be obtained from the following equations:

$$b = c + 5L \times 10^{-3} \text{ m (ft)} \quad \text{but } b \text{ need not be greater than } 1.8 \text{ m (5.9 ft)}$$

where

$$\begin{aligned} b &= \text{width of sheerstrake, in m (ft)} \\ c &= 0.8 \text{ (2.625)} \\ L &= \text{scantling length of vessel, in m (ft)} \end{aligned}$$

The sheerstrake thickness is not to be less than the thickness of the strength deck stringer plate nor is it to be less than the thickness of the adjacent side shell plating.

In way of breaks of superstructures, the thickness of the sheerstrake is to be increased by 25%, but this increase need not exceed 6.5 mm (0.25 in.). Where breaks in way of the forecastle or poop are appreciably beyond $0.5L$ amidships, this requirement may be modified.

The top edge of the sheerstrake is to be smooth and free of notches. Fittings and bulwarks are not to be welded to the top edge of the sheerstrake within $0.8L$ amidships, nor in way of superstructure breaks throughout.

7.9 Frames

7.9.1 General

The side framing structure is in general to be in accordance with the Rules, Sections 3-2-5 and 3-2-6 and with the following.

7.9.2 Longitudinal Frames

7.9.2(a) *Below the Freeboard or Bulkhead Deck, whichever is higher.* The section modulus SM of side shell longitudinals below the freeboard/bulkhead deck is to be obtained from the following equation:

$$SM = kchs\ell^2Q \text{ cm}^3 \text{ (in}^3\text{)}$$

where

$$\begin{aligned} k &= 7.8 \text{ (} 4.1 \times 10^{-3} \text{)} \\ c &= 0.95 \\ s &= \text{spacing of side shell longitudinals, in m (ft)} \\ h &= 0.75(D_{fd} - z) \text{ m (ft)} \quad \text{for } z \leq 0.5D_{fd} \\ &\quad \text{but } h \text{ is not to be taken less than } 0.5D_{fd} \text{ m (ft)} \end{aligned}$$

h	=	$D_{fd} - z$ m (ft)	for $z > 0.5D_{fd}$
		but h is not to be taken less than:	
		2.13 m (7 ft)	for $L \leq 176$ m (580 ft)
		$h_1 + 5L \times 10^{-3}$ m (ft)	for $L > 176$ m (580 ft)
h_1	=	1.25 (4.1)	
ℓ	=	span of longitudinal between effective supports, in m (ft), as shown in 5C-7-2/Figure 2	
D_{fd}	=	vertical distance from the baseline to the freeboard/bulkhead deck at side amidships, in m (ft)	
z	=	vertical distance from the baseline to the side shell longitudinal under consideration, in m (ft)	
L	=	scantling length of vessel, in m (ft)	
Q	=	material conversion factor	
	=	1.0	for ordinary strength steel
	=	0.78	for H32 strength steel
	=	0.72	for H36 strength steel
	=	0.68	for H40 strength steel

The section modulus of the side shell longitudinals below the freeboard/bulkhead deck is also not to be less than is required for the first side shell longitudinal above the freeboard/bulkhead deck, adjusted for the spacing of the side longitudinals.

7.9.2(b) *Above the Freeboard or Bulkhead Deck, whichever is higher.* The section modulus SM of side shell longitudinals above the freeboard/bulkhead deck is to be obtained from the following equation:

$$SM = kchs\ell^2Q \text{ cm}^3 (\text{in}^3)$$

where

k	=	7.8 (4.1×10^{-3})	
c	=	0.95	
s	=	spacing of side shell longitudinal, in m (ft)	
ℓ	=	span of longitudinal between effective supports, in m (ft), as shown in 5C-7-2/Figure 2	
h	=	$0.5a[(bf) - y]$ m (ft)	
	=	h is not to be taken less than $1.25 + 5L \times 10^{-3}$ m ($4.1 + 5L \times 10^{-3}$ ft), while L need not be taken greater than 250 m (820 ft).	
a	=	$0.5 + 6.67L \times 10^{-3}$ ($0.5 + 2.03L \times 10^{-3}$), while L need not be taken greater than 300 m (984 ft)	
b	=	$1.0 + \left[\frac{(x/L) - 0.45}{C_b + 0.2} \right]^2$	for $x/L \leq 0.45$
	=	$1.0 + 1.5 \left[\frac{(x/L) - 0.45}{C_b + 0.2} \right]^2$	for $x/L > 0.45$
C_b	=	vessel's block coefficient, but is not to be taken as less than 0.6 nor greater than 0.8	

x	=	distance from the AP to the middle of the span of the longitudinal being considered, in m (ft). Alternatively, the side shell may be divided into equal parts not exceeding $0.15L$ in length and x , for all longitudinals within a part, may be measured from the AP to the center of the part where the side shell longitudinal being considered is located.
L	=	scantling length of vessel, in m (ft)
f	=	$(3.52 - 929/L^{1.5})^2$ m but L need not be taken greater than 275 m
	=	$(6.375 - 10000/L^{1.5})^2$ ft but L need not be taken greater than 900 ft
y	=	vertical distance, in m (ft), from the summer load waterline to the side shell longitudinal under consideration
Q	=	material conversion factor
	=	1.0 for ordinary strength steel
	=	0.78 for H32 strength steel
	=	0.72 for H36 strength steel
	=	0.68 for H40 strength steel

7.9.3 Transverse Frames

7.9.3(a) *Frames Below the Lowest Deck.* The section modulus SM of side shell frames below the lowest deck is to be obtained from the following equations:

$$SM = c s \ell^2 (h + k b h_1/30) (7 + 45/\ell^3) Q \text{ cm}^3 \quad \text{for } \ell \leq 3.83 \text{ m}$$

$$SM = 4.74 c s \ell^2 (h + b h_1/45 k_1) Q \text{ cm}^3 \quad \text{for } \ell > 3.83 \text{ m}$$

$$SM = c s \ell^2 (h + k b h_1/100) (3.7 \times 10^{-3} + 0.8/\ell^3) Q \text{ in}^3 \quad \text{for } \ell \leq 12.57 \text{ ft}$$

$$SM = 2.5 c s \ell^2 10^{-3} (h + b h_1/150 k_1) Q \text{ in}^3 \quad \text{for } \ell > 12.57 \text{ ft}$$

where

c	=	1.0 for $\ell \leq 3.81 \text{ m}$ (12.5 ft)
	=	1.5 for $\ell > 3.81 \text{ m}$ (12.5 ft)
s	=	transverse frame spacing, in m (ft)
ℓ	=	span of frame, in m (ft), as shown in 5C-7-2/Figure 3, but ℓ for use with the equation is not to be taken less than 2.13 m (7 ft)
h	=	vertical distance, in m (ft), from the middle of ℓ to the load line, or 0.5ℓ , whichever is greater
b	=	horizontal distance, in m (ft), from the outside of the frame to the first row of deck supports such as (e.g., longitudinal deck girders)
h_1	=	vertical distance, in m (ft), from the deck at the top of the frame to the freeboard or bulkhead deck, whichever is greater, plus the height of all tween-deck spaces, or plus 2.44 m (8 ft) if that be greater. Where the intended deck loading ρ is known, the height of that tween-deck may be taken as ρ/ω in calculating h_1 .
ρ	=	intended deck loading, in kN/m ² (kgf/m ² , lbf/ft ²), but is not to be taken less than the minimum deck loading given in 5C-7-2/Table 3
ω	=	7.06 (720, 45)
k	=	0.0 where the deck is longitudinally framed
	=	the number of transverse frame spaces between web frames where the deck is transversely framed

- k_1 = 1.0 where the deck is longitudinally framed
= the number of transverse frame spaces between web frames where the deck is transversely framed
- Q = material conversion factor
= 1.0 for ordinary strength steel
= 0.78 for H32 strength steel
= 0.72 for H36 strength steel
= 0.68 for H40 strength steel

7.9.3(b) *Frames Between the Lowest Deck and the Strength Deck.* The section modulus SM of side shell frames between the lowest deck and the strength deck is to be obtained from the following equation:

$$SM = c s \ell^2 (7 + 45/\ell^3) K Q \text{ cm}^3$$

$$SM = c s \ell^2 (3.7 \times 10^{-3} + 0.8/\ell^3) K Q \text{ in}^3$$

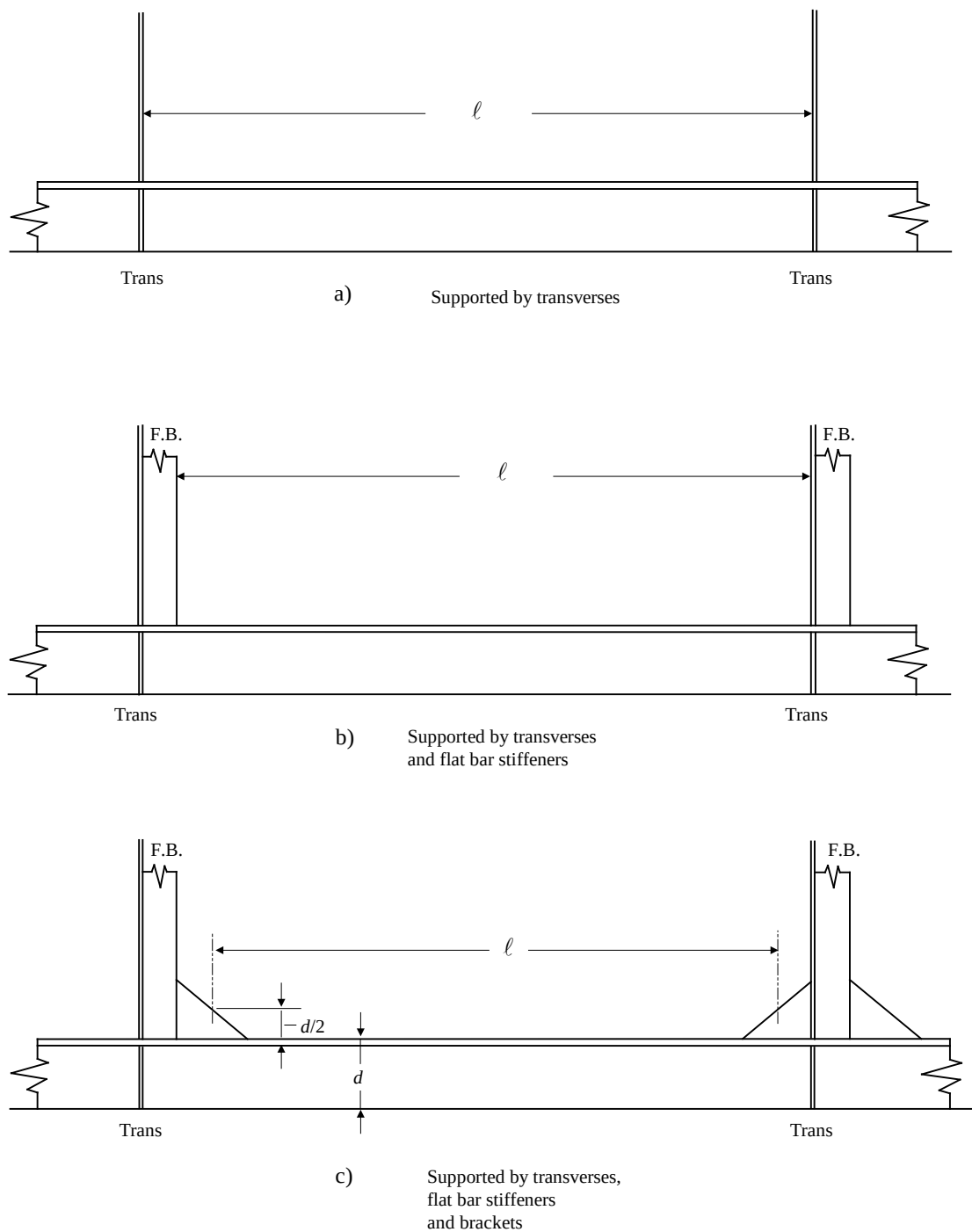
where

- c = 1.2 for the uppermost tween-deck immediately below the strength deck
= 1.0 for all other tween-decks
- s = transverse frame spacing, in m (ft)
- ℓ = tween-deck height or unsupported span along the frame length, whichever is greater, in m (ft)
- K = factor appropriate to the length of vessel and type of tween deck, A, B, C, or D, as shown in 5C-7-2/Figure 3. Note: all frames of tween-decks above the freeboard/bulkhead deck are to be type A.
- L = scantling length of vessel, but need not be taken greater than 305 m (1000 ft)
- Q = material conversion factor
= 1.0 for ordinary strength steel
= 0.78 for H32 strength steel
= 0.72 for H36 strength steel
= 0.68 for H40 strength steel

TABLE 3
Minimum Deck Loading

Deck	Minimum Deck Loading ρ		
	kN/m^2	kgf/m^2	lbf/ft^2
Tween-decks used solely for passenger accommodation	3.53	360	74
Tween-decks in way of public spaces	6.464	659	135
Tween-decks in way of baggage spaces	$3.53h_{tw}$	$360h_{tw}$	$22.5h_{tw}$
Decks in way of stores and refrigerated spaces	14.364	1465	300
Decks in way of machinery spaces and workshops	18.434	1880	385
Strength and lower decks in way of accommodation	5.745	586	120
Note: h_{tw} is the tween deck height in m (ft)			

FIGURE 2
Unsupported Span of Longitudinal



7.11 Web Frames and Stringers

7.11.1 General

Side shell web frames and stringers are in general to be in accordance with Section 3-2-6 of the Rules and with the following.

7.11.2 Side Web Frames and Side Stringers Below the Lowest Deck

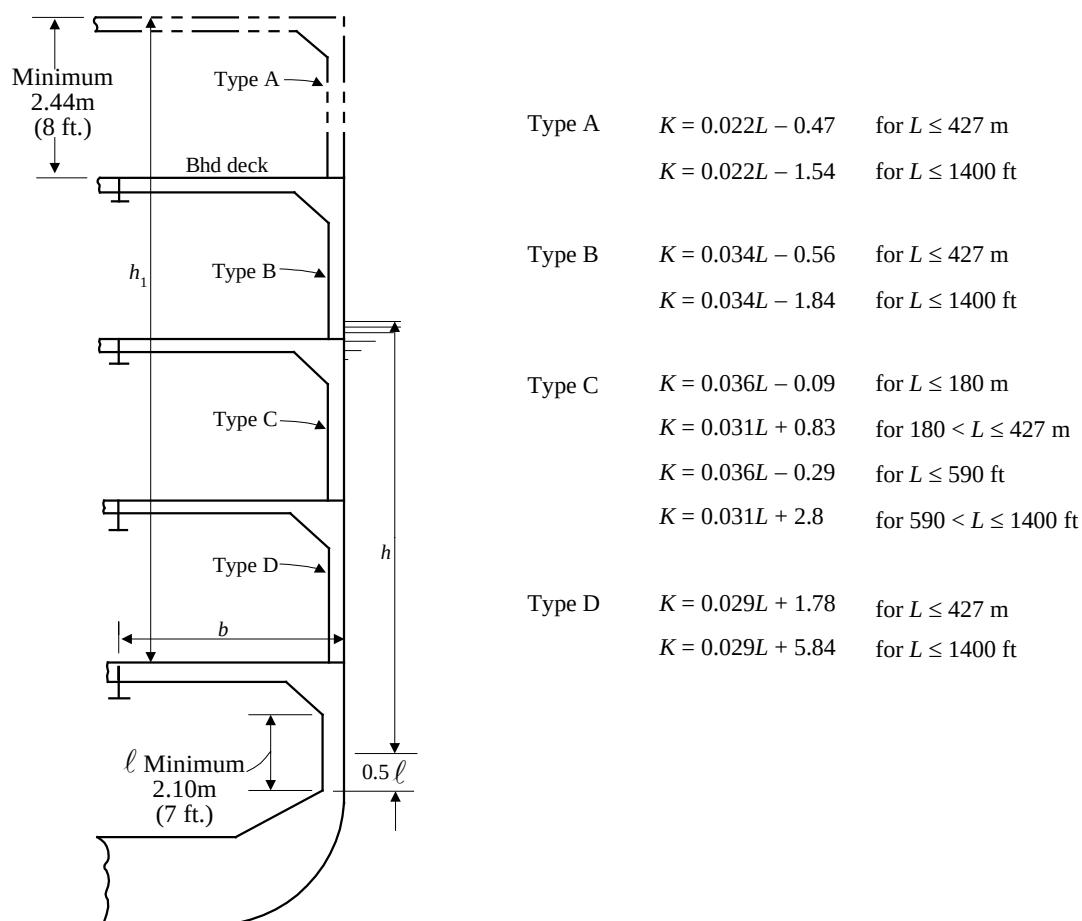
In addition to satisfying the requirements in Section 3-2-6 of the Rules, side web frames and side stringers located below the lowest deck are to have a section modulus SM not less than obtained from the following equation:

$$SM = k c s (h + 0.025L) \ell^2 Q \text{ cm}^3 \text{ (in}^3\text{)}$$

where

- | | | |
|--------|---|--|
| k | = | 4.74 (2.5 × 10 ⁻³) |
| c | = | 1.5 |
| s | = | sum of the half lengths (on each side of the web frame or side stringer) of the frames supported, in m (ft) |
| h | = | vertical distance, in m (ft), from the middle of ℓ in the case of web frames and from the middle of s in the case of side stringers, to the summer load line |
| L | = | scantling length of vessel, but need not be taken greater than 247 m (810 ft) |
| ℓ | = | span measured between the heels of the end attachments, in m (ft), except that where effective brackets are fitted, ℓ may be modified in accordance with the following. |
- i) Where the face area on the bracket is not less than one-half that on the girder or web and the face plate or flange on the girder or web is carried to the bulkhead or base, the length ℓ may be measured to a point 150 mm (6 in.) on to the bracket.
 - ii) Where the face area on the bracket is less than one-half that on the girder or web and the face plate or flange on the girder or web is carried to the bulkhead or base, ℓ may be measured to a point where the area of the bracket and its flange, outside the line of the girder or web, is equal to the flange area on the girder.
 - iii) Where the face plate or flange area of the girder or web is carried along the face of the bracket, which may be curved for the purpose, ℓ may be measured to the point of the bracket.
 - iv) Brackets are not to be considered effective beyond the point where the arm on the girder or web is 1.5 times the length of the arm on the bulkhead or base; and in no case is the allowance in ℓ at either end to exceed one-quarter of the over-all length of the girder or web.
- | | | |
|-----|---|---------------------------------|
| Q | = | material conversion factor |
| | = | 1.0 for ordinary strength steel |
| | = | 0.78 for H32 strength steel |
| | = | 0.72 for H36 strength steel |
| | = | 0.68 for H40 strength steel |

FIGURE 3
Hold and Tween Deck Frames



7.11.3 Shear Area

7.11.3(a) *Web Frames and Side Stringers Below the Lowest Deck.* Clear of, and in way of the cutouts for the longitudinals, the shear area A_s of the web frames and side stringers is not to be less than obtained from the following equation:

$$A_s = c s (h + 0.025L) / f_y \quad \text{cm}^2 \text{ (in}^2\text{)}$$

where

- c = 125.5 (12.8, 80)
- s = sum of half lengths (on each side of the web frame or side stringer) of the frames supported, in m (ft)
- h = vertical distance, in m (ft), from the middle of ℓ in the case of web frames and from the middle of s in the case of side stringers, to the summer load line
- L = scantling length of vessel, but need not be taken greater than 247 m (810 ft)
- ℓ = span of the web frame or side stringer measured between the heels of the end attachments, in m (ft). Where effective brackets are fitted, ℓ may be modified as indicated in 5C-7-2/7.11.2.
- f_y = minimum specified yield point of the material in N/mm² (kgf/mm², lbf/in²)

7.11.3(b) *Tween-deck Web Frames.* Clear of, and in way of the cutouts for the longitudinals, the shear area of the web of tween-deck web frames is not to be less than obtained from the following equation:

$$A_s = c s_w h_t \ell / f_y \quad \text{cm}^2 \text{ (in}^2\text{)}$$

where

- c = 125.5 (12.8, 80)
- s_w = web spacing, in m (ft)
- h_t = $h + b h_1 / 45 k$ m
= $h + b h_1 / 150 k$ ft
- h = vertical distance, in m (ft), from the middle of ℓ to the load line, or 0.5ℓ whichever is greater
- b = horizontal distance, in m (ft), from the outside of the web frame to the first row of deck supports such as (e.g., longitudinal deck girders)
- h_1 = vertical distance, in m (ft), from the deck at the top of the frame to the freeboard or bulkhead deck, whichever is greater, plus the height of all tween-deck spaces, or plus 2.44 m (8 ft) if that be greater.
Where the intended deck loading ρ is known, the height of that tween-deck may be taken as ρ / ω in calculating h_1 .
- ρ = intended deck loading, in kN/m² (kgf/m², lbf/ft²), but is not to be taken less than the minimum deck loading given in 5C-7-2/Table 3
- ω = 7.06 (720, 45)
- k = 1.0, where the deck is longitudinally framed
= the number of transverse frame spaces between web frames where the deck is transversely framed
- ℓ = unsupported span of the web frame, in m (ft)
- f_y = minimum specified yield point of the material in N/mm² (kgf/mm², lbf/in²)

7.11.4 Proportions

7.11.4(a) *Web Frames and Side Stringers Below the Lowest Deck.* The webs are to have depths of not less than 0.125ℓ plus one-quarter of the depth of the slots for the frames. In general, the depth is not to be less than 3 times the depth of the slots. The thickness is not to be less than 1% of the web depth in mm (in.) plus 3 mm (0.12 in.) but need not exceed 11.5 mm (0.46 in.).

7.11.4(b) *Tween-deck Web Frames.* The webs are to have depths of not less than 0.125ℓ plus one-quarter of the depth of the cutout slots for the longitudinals. The thickness of the web is not to be less than 10 mm per 1.0 m (0.12 in. per ft) of depth.

7.13 Portlights

The location and construction of portlights and deadlights is to comply with 3-2-17/7 of the Rules.

7.15 Gangway and Cargo Ports Located Below the Margin Line

Closing appliances for gangway and cargo ports fitted below the margin line are to be of sufficient strength. They are to be capable of being effectively closed and secured watertight. The closing appliance scantlings are to be equivalent to the scantlings required for the hull structure in that location. Closing appliances are to normally open outboard. Closing appliances that open inboard are to have portable strong-backs or props in addition to the regular dogs. See also 3-2-16/1 of the Rules.

Gangway and cargo ports are to have their lowest point above the deepest subdivision load line.

7.17 Weathertight and Watertight Integrity Above the Margin Line

All reasonable and practicable measures are to be taken to limit the entry and spread of water above the bulkhead deck. Such measures may include partial bulkheads or webs.

7.17.1 Partial Watertight Bulkheads and Webs

Where partial watertight bulkheads and webs are fitted on the bulkhead deck above or in the immediate vicinity of main subdivision bulkheads, they are to have watertight shell and bulkhead deck connections in order to restrict the flow of water along the deck when the vessel is in a heeled damaged condition. Where a partial watertight bulkhead does not line up with a bulkhead below, the bulkhead deck between is to be made effectively watertight.

7.17.2 Weather Deck

The deck above the bulkhead deck or the bulkhead deck itself is to be weathertight. All openings in the exposed weather deck are to have coamings of ample height and strength and are to be provided with efficient means to expeditiously close them weathertight. Freeing ports, open rails and scuppers are to be fitted as necessary for rapidly clearing the weather deck of water under all weather conditions.

7.17.3 Air Pipes Terminating within a Superstructure

The open end of air pipes, from tanks other than oil tanks, terminating within a superstructure are to be at least 1 m (3.28 ft) above the waterline when the ship heels to an angle of 15°, or the maximum angle of heel during intermediate stages of flooding as determined by direct calculation, whichever is the greater. Alternatively, these air pipes may discharge through the side of the superstructure.

7.17.4 Protection of Shell Openings

Closing appliances for gangway, cargo and fueling ports and for portlights and other openings in the shell plating are to be of efficient design and construction and of sufficient strength having regard to the spaces in which they are fitted and their positions relative to the deepest subdivision load line.

7.17.5 Deadlights

Efficient inside deadlights are to be provided for all sidescuttles to spaces below the first deck above the bulkhead deck and so arranged that they can be easily and effectively closed and secured watertight.

9 Deck Construction

9.1 General

Decks and their supporting structures are generally to be in accordance with the Rules, Sections 3-2-3 for plating, 3-2-7 for beams and 3-2-8 for pillars, girders and transverses and in accordance with the following paragraphs.

9.3 Deck Plating

9.3.1 Strength Deck

The strength deck plating thickness t is, in general, to be in accordance with the following equation:

$$t = ks\mu \times 10^{-3} + a \quad \text{mm (in.)}$$

where

k	=	for transversely framed strength deck
	=	10.0 where $s \leq 760$ mm (30 in.)
	=	6.6 where $s > 760$ mm (30 in.)
k	=	for longitudinally framed strength deck
	=	9.0 where $s \leq 760$ mm (30 in.)
	=	6.0 where $s > 760$ mm (30 in.)

s	=	spacing of beams, in mm (in.)
μ	=	material conversion factor
	=	1.0 for ordinary strength steel
	=	0.866 for H32 strength steel
	=	0.8165 for H36 strength steel
	=	0.8 for H40 strength steel
a	=	for exposed transversely framed strength deck
	=	2.3 mm (0.09 in.) where $s \leq 760$ mm (30 in.)
	=	4.9 mm (0.193 in.) where $s > 760$ mm (30 in.)
a	=	for exposed longitudinally framed strength deck
	=	2.4 mm (0.095 in.) where $s \leq 760$ mm (30 in.)
	=	4.7 mm (0.185 in.) where $s > 760$ mm (30 in.)
a	=	for transversely framed strength deck within superstructures or deckhouses
	=	1.3 mm (0.05 in.) where $s \leq 760$ mm (30 in.)
	=	3.9 mm (0.153 in.) where $s > 760$ mm (30 in.)
a	=	for longitudinally framed strength deck within superstructures or deckhouses
	=	1.4 mm (0.055 in.) where $s \leq 760$ mm (30 in.)
	=	3.7 mm (0.145 in.) where $s > 760$ mm (30 in.)

9.3.2 Effective Lower Decks

Where an analysis based upon the ultimate strength is submitted, the requirements for the thickness of effective lower decks in 3-2-3/5.3 of the Rules may be specially considered.

9.3.3. Platform Decks

Lower decks that are not considered to be effective decks for longitudinal strength are termed platform decks.

The plating thickness t , is not to be less than the greater of the following:

$$t_1 = ks\mu \sqrt{h} + a \text{ mm (in.)}$$

$$t_2 = 5.8s\mu \times 10^{-3} + b \text{ mm (in.)} \quad \text{but } t_2 \text{ is not to be less than 4.5 mm (0.18 in.)}$$

where

k	=	3.94×10^{-3} (2.18×10^{-3})
s	=	spacing of beams, in mm (in.)
μ	=	material conversion factor
	=	1.0 for ordinary strength steel
	=	0.866 for H32 strength steel
	=	0.8165 for H36 strength steel
	=	0.8 for H40 strength steel
h	=	ρ/ω m (ft)
ρ	=	intended deck loading, in kN/m ² (kgf/m ² , lbf/ft ²) but is not to be taken less than the minimum deck loading given in 5C-7-2/Table 3

$$\omega = 7.06 (720, 45)$$

$$a = 1.5 (0.06)$$

$$b = 1.0 (0.04)$$

9.5 Beams

Each beam, in association with the plating to which it is attached, is to have a section modulus SM as obtained from the following equation:

$$SM = kchs\ell^2Q \text{ cm}^3 (\text{in}^3)$$

where

$$k = 7.8 (4.1 \times 10^{-3})$$

$$c = \text{for transverse beams}$$

$$= 0.54 \quad \text{for half beams, for beams with centerline support only, for beams between longitudinal bulkheads, and for beams over tunnels or tunnel recesses}$$

$$= 0.585 \quad \text{for beams between longitudinal deck girders}$$

$$= 0.9 \quad \text{for beams at deep-tank tops supported at one or both ends at the shell or on longitudinal bulkheads}$$

$$= 1.0 \quad \text{for beams at deep-tank tops between longitudinal girders}$$

$$c = \text{for longitudinal beams}$$

$$= 1/(1.709 - 0.651k_1) \quad \text{for longitudinal beams of strength decks and of effective lower decks}$$

$$= 0.585 \quad \text{for longitudinal beams of platform decks}$$

$$= 1.0 \quad \text{for beams at deep-tank tops}$$

$$k_1 = SM_R Y / I_A$$

$$SM_R = \text{required hull girder section modulus amidships in cm}^2\text{-m (in}^2\text{-ft). See 3-2-1/3.7.1 of the Rules}$$

$$Y = \text{distance, in m (ft), from the neutral axis of the hull girder inertia } I_A, \text{ to the deck being considered, always to be taken as positive}$$

$$I_A = \text{actual hull girder moment of inertia of the vessel amidships, in cm}^2\text{-m}^2 (\text{in}^2\text{-ft}^2)$$

$$s = \text{spacing of beams, in m (ft)}$$

$$\ell = \text{for transverse beams}$$

$$= \text{distance, in m (ft), from the inner edge of the beam knee to the nearest line of girder support or between girder supports, whichever is greater. Normally } \ell \text{ is not to be taken less than } 0.2B. \text{ Under the top of deep tanks and in way of bulkhead recesses, the supports are to be arranged to limit the span of the beams to not more than 4.57 m (15 ft)}$$

$$\ell = \text{for longitudinal beams}$$

$$= \text{span of the longitudinal between effective supports, in m (ft), as shown in 5C-7-2/Figure 2}$$

$$B = \text{breadth of vessel, in m (ft)}$$

$$h = \text{for exposed strength deck}$$

$$= 2.43\sqrt{L} + 2.92 \times 10^4/L^{1.5} - 1.64 \times 10^5/L^2 - 35.78 \text{ m}$$

$$= 4.4\sqrt{L} + 5.7 \times 10^5/L^{1.5} - 5.8 \times 10^6/L^2 - 117.4 \text{ ft}$$

- h = for other decks
= is normally the tween-deck height, in m (ft), but where the intended deck loading ρ is known, h may be taken as ρ/ω m (ft).
- h = for bulkhead recesses and tunnel flats
= the height, in m (ft), to the margin line; where that height is less than 6.10 m (20 ft), the value of h is to be taken as 0.8 times the actual height plus 1.22 m (4 ft).
- h = for deep-tank tops
= the greatest of the following:
i) two-thirds of the distance in m (ft) from the top of the tank to the top of the overflow
ii) $0.015L - 0.1524$ m ($0.015L - 0.5$ ft)
iii) the height in m (ft) to the load line or two-thirds of the height to the margin line, whichever is greatest.
- L = scantling length of vessel, in m (ft), but need not be taken greater than 122 m (400 ft) in the above equations
- ρ = intended deck loading in, kN/m^2 (kgf/m^2 , lbf/ft^2), but is not to be taken less than the minimum deck loading given in 5C-7-2/Table 3
- ω = 7.04 (715, 45)

11 Watertight Bulkheads and Doors

11.1 Application

Passenger vessels are to be provided with strength and watertight bulkheads. The number and location of bulkheads provided to effectively subdivide the vessel are to satisfy the requirements of Regulation II-1/6 through II-1/8-1 of the 1974 SOLAS Convention, as amended. Plans submitted are to show clearly the location and extent of the bulkheads. Watertight bulkheads constructed in accordance with this Chapter are to be recorded in the *Record* as **WT** (watertight), the symbols being prefixed in each case by the number of such bulkheads. See also Section 5C-7-3.

11.3 Construction

11.3.1 Plating

The plating thickness is to be not less than obtained from the following equation:

$$t = skc\mu\sqrt{h} \cdot 10^{-4} - 39L \times 10^{-4} + 1.15 \text{ mm} \quad \text{but } t \text{ is not to be less than } 5.0 \text{ mm or } s/200 + 1.5 \text{ mm, whichever is greater}$$

$$t = skc\mu\sqrt{h} \cdot 10^{-4} - 47L \times 10^{-6} + 0.045 \text{ in.} \quad \text{but } t \text{ is not to be less than } 0.20 \text{ in. or } s/200 + 0.06 \text{ in., whichever is greater}$$

where

- t = plating thickness, in mm (in).
 s = spacing of stiffeners, in mm (in).
 k = $(3.075\sqrt{\alpha} - 2.077)/(\alpha + 0.272)$ where $1 \leq \alpha \leq 2$
= 1.0 where $\alpha > 2$
 α = aspect ratio of the panel (longer edge/shorter edge)
 c = 39.37 (21.735) for collision bulkhead
= 34.48 (19.036) for other watertight bulkhead