Test Procedures for Watertight Compartments

Amended Rules and Guidance

Rules for the Survey and Construction of Steel Ships Parts B and C
Rules for High Speed Craft
Guidance for the Survey and Construction of Ships of Fibreglass Reinforced Plastics

Reason for Amendment

IACS Unified Requirement (UR) S14 specifies testing procedures for watertight compartments and it has already been incorporated as an annex into Part B of the Rules for the Survey and Construction of Steel Ships.

Although the UR includes requirements for structural tests (including test heads) based on the SOLAS Convention, IACS discussed also applying such requirements to Non-SOLAS ships in order to achieve uniform application in accordance with the requirements for SOLAS Ships.

As a result, IACS amended the UR to add a new part (Part C) which specifies requirements for Non-SOLAS ships, in addition to Part A(SOLAS ships) and Part B(SOLAS exempt/equivalent ships). In addition, IACS also reviewed relevant requirements based on their actual application and amended them as needed. IACS adopted the changes it made as UR S14 (Rev. 7) in December 2022.

Therefore, relevant requirements are amended in accordance with UR S14(Rev. 7).

Outline of Amendment

(1) Add Chapter 3 to Annex 2.1.5, Part B of the Rules for the Survey and Construction of Steel Ships to specify requirements for structural tests for Non-SOLAS ships.
(2) Amend requirements for structural tests of spaces other than tanks to specify that structural tests of at least one compartment from each group only need to be carried out for subsequent vessels in the series.
(3) Amend the design loads for test conditions specified in Part C of the Rules for the Survey and Construction of Steel Ships to specify that the reduced test heads may be used for Non-SOLAS ships.
(4) Amend the Rules for High Speed Craft to specify that structural tests are to be carried out in accordance with Annex 2.1.5, Part B of the Rules for the Survey and Construction of Steel Ships.

"Rules for the survey and construction of steel ships" has been partly amended as follows:

Part B CLASS SURVEYS

Chapter 2 CLASSIFICATION SURVEYS

2.1 Classification Survey during Construction

2.1.5 Hydrostatic Tests, Watertight Tests, and Relevant Tests*

Sub-paragraph (1) has been amended as follows.

In the Classification Survey during Construction, hydrostatic tests, watertight tests, and other relevant tests are to be carried out in accordance with the following:

(1) Hull and equipment

The watertightness and the structural adequacy of tanks and watertight boundaries as well as the weathertightness of other structures and shipboard outfittings are to be verified by following **(a)** and **(b)**.

(a) For ships subject to *SOLAS Convention*, the tests stipulated in *SOLAS Chapter II-1 Regulation 11*, except where specially approved by the Administration; and

(b) The tests stipulated in the following **i)** ~~**or ii**~~to **iii)**:

i) Testing procedures of watertight compartments for ships subject to *SOLAS Convention* (including ships subject to **Part CSR-B&T**) are to be carried out in accordance with **Chapter 1, ~~of~~ Annex 2.1.5 "Testing Procedures of Watertight Compartments"**, unless:

1) the shipyard provides documentary evidence of the shipowner's agreement to a request to the Flag Administration for an exemption from the application of *SOLAS Chapter II-1*, *Regulation 11*, or for an equivalency agreeing that the content of **Chapter 2, ~~of~~ Annex 2.1.5 "Testing Procedures of Watertight Compartments"** is equivalent to *SOLAS Chapter II-1*, *Regulation 11*; and

2) the above-mentioned exemption/equivalency has been granted by the responsible Flag Administration.

ii) Testing procedures of watertight compartments are to be carried out in accordance with **Chapter 2, ~~of~~ Annex 2.1.5 "Testing Procedures of Watertight Compartments"** for ~~ships not subject to *SOLAS Convention* and~~ ships subject to *SOLAS Convention* (including ships subject to **Part CSR-B&T**) for which:

1) the shipyard provides documentary evidence of the shipowner's agreement to a request to the Flag Administration for an exemption from the application of *SOLAS Chapter II-1*, *Regulation 11*, or for an equivalency agreeing that the content of **Chapter 2, ~~of~~ Annex 2.1.5 "Testing Procedures of Watertight Compartments"** is equivalent to *SOLAS Chapter II-1*, *Regulation 11*; and

2) the above-mentioned exemption/equivalency has been granted by the responsible Flag Administration.

iii) Testing procedures of watertight compartments for ships not subject to *SOLAS Convention* are to be carried out in accordance with **Chapter 3, Annex 2.1.5 "Testing Procedures of Watertight Compartments"**

(2) Machinery

Hydrostatic, leakage or airtight tests are to be carried out as specified in each Chapter of **Part**

D in relation to the kind of machinery.

Annex 2.1.5 TESTING PROCEDURES OF WATERTIGHT COMPARTMENTS

Chapter 1 SHIPS SUBJECT TO *SOLAS CONVENTION*

An1.3 Test Types and Definitions

An1.3.1 Tests

Sub-paragraph -3 has been amended as follows.

1 The following two types of tests are specified in this requirement:

(1) Structural Test

A test to verify the structural adequacy of tank construction. This may be a hydrostatic test or, where the situation warrants, a hydropneumatic test.

(2) Leak Test

A test to verify the tightness of a boundary. Unless a specific test is indicated, this may be a hydrostatic/hydropneumatic test or an air test. A hose test may be considered an acceptable form of leak test for certain boundaries, as indicated ~~by~~in **Note *3, Table An1.4-1~~, Footnote 3~~**.

2 The definition of each test type is as indicated ~~by~~in **Table An1.3.1**.

3 The 'top of the overflow' is defined as being the top of any overflow system which is used to prevent overfilling of a tank. Such system can be an overflow pipe, airpipe, intermediate tank. For gravity tanks (i.e. sewage, grey water and similar tanks, not filled with pumps) the top of the overflow is to be taken as the highest point of the filling line.

Note: Gauging devices are not considered equivalent to an overflow system with the exception of fuel oil overflow tanks not intended to hold fuel which have been fitted with a level alarm. Where a tank is fitted with multiple means of preventing overfilling, the decision on which overflow system is to be used to determine the test head is to be based on the highest point to which the liquid may rise in service.

An1.4 Test Procedures

An1.4.2 Structural Test Procedures

Sub-paragraph -2 has been renumbered to Sub-paragraph -3, and Sub-paragraph -2 has been added as follows.

1 Type and time of test

Where a structural test is specified in **Table An1.4-1** or **An1.4-2**, a hydrostatic test in accordance with **An1.4.4-1** will be acceptable. Where practical limitations (strength of building berth, light density of liquid, etc.) prevent the performance of a hydrostatic test, a hydropneumatic test in accordance with **An1.4.4-2** may be accepted instead.

A hydrostatic test or hydropneumatic test for the confirmation of structural adequacy may be carried out while the ship is afloat, provided the results of a leak test are confirmed to be satisfactory before the ship is afloat.

2 Alternative equivalent tank testing procedures may be considered for tanks which are constructed from composite materials such as glass reinforced plastic (GRP) and fibre reinforced plastic (FRP) based on the recommendations of the composite manufacturer.

~~**2**~~**3** Testing schedule for new construction or major structural conversion is as follows.

(1) Tanks which are intended to hold liquids, and which form part of the watertight subdivision of the ship, are to be tested for tightness and structural strength as indicated in **Table An1.4-1** and **Table An1.4-2**.

(2) The tank boundaries are to be tested from at least one side. The tanks for structural test are to be selected so that all representative structural members are tested for the expected tension and compression.

(3) For the watertight boundaries of spaces other than tanks structural testing may be exempted, provided that the water-tightness of boundaries of exempted spaces is verified by leak tests and inspections. Structural testing may not be exempt and the requirements for structural testing of tanks in **(1)** and **(2)** above shall apply, for ballast holds, chain lockers and a representative cargo hold if intended for in-port ballasting.

An1.4.4 Test Methods

Sub-paragraph -1 has been amended as follows.

1 Hydrostatic test

Unless another liquid is approved, hydrostatic tests are to consist of filling the space with fresh water or sea water, whichever is appropriate for testing, to the level specified in **Table An1.4-1** or **Table An1.4-2**. See also **An1.4.7**.

In cases where a tank is designed for cargo densities greater than sea water and testing is with fresh water or sea water, the testing pressure height is to simulate the actual loading for those greater cargo densities as far as practicable~~.~~, but the test pressure is not to exceed the maximum design internal pressure at the top of tank.

All external surfaces of the tested space are to be examined for structural distortion, bulging and buckling, other related damage and leaks.

Table An 1.4-1 has been amended as follows.

Table An 1.4-1 Test Requirements for Tanks and Boundaries

	Tank or boundary to be tested	Test type	Test head or pressure	Remarks
1	Double bottom tanks[*4]	Leak and structural[*1]	The greater of - top of the overflow,[*10] - to 2.4 *m* above top of tank[*2], or - to bulkhead deck	
2	Double bottom voids[*5]	Leak	See **An-1.4.4-4** through **-6**, as applicable	including pump room double bottom and bunker tank protection double hull required by **Part 3, ~~of the~~ Rules for Marine Pollution Prevention Systems**
3	Double side tanks	Leak and structural[*1]	The greater of - top of the overflow,[*10] - to 2.4 *m* above top of tank[*2], or - to bulkhead deck	
4	Double side voids	Leak	See **An-1.4.4-4** through **-6**, as applicable	
5	Deep tanks other than those listed elsewhere in this table	Leak and structural[*1]	The greater of - top of the overflow[*10], or - to 2.4 *m* above top of tank[*2]	
6	Cargo oil tanks	Leak and structural[*1]	The greater of - top of the overflow,[*10] - to 2.4 *m* above top of tank[*2], or - to top of tank[*2] plus ~~setting of any~~ the design vapour pressure ~~relief valve~~	
7	Ballast hold of bulk carriers	Leak and structural[*1]	Top of cargo hatch coaming	
8	Peak tanks	Leak and structural[*1]	The greater of - top of the overflow[*10], or - to 2.4 *m* above top of tank[*2]	After peak to be tested after installation of stern tube
9	.1 Fore peak spaces with equipment	Leak	See **An-1.4.4-3** through **-6**, as applicable	
	.2 Fore peak voids	Leak	See **An-1.4.4-4** through **-6**, as applicable	
	.3 Aft peak spaces with equipment	Leak	See **An-1.4.4-3** through **-6**, as applicable	
	.4 Aft peak voids	Leak	See **An-1.4.4-4** through **-6**, as applicable	After peak to be tested after installation of stern tube
10	Cofferdams	Leak	See **An-1.4.4-4** through **-6**, as applicable	
11	.1 Watertight bulkheads	Leak[*8]	See **An-1.4.4-3** through **-6**, as applicable [*7]	
	.2 Superstructure end bulkheads	Leak	See **An-1.4.4-3** through **-6**, as applicable	
12	Watertight doors below freeboard or bulkhead deck	Leak[*6,7]	See **An-1.4.4-3** through **-6**, as applicable	
13	Double plate rudder blades	Leak	See **An-1.4.4-4** through **-6**, as applicable	

Table An-1.4-1 Test Requirements for Tanks and Boundaries (Continued)

	Tank or boundary to be tested	Test type	Test head or pressure	Remarks
14	Shaft tunnels clear of deep tanks	Leak[*3]	See **An-1.4.4-3** through **-6**, as applicable	
15	Shell plating	Leak[*3]	See **An-1.4.4-3** through **-6**, as applicable	For shell plating of the areas listed in item 1 through item 10, refer to the corresponding item
16	Shell doors	Leak[*3]	See **An-1.4.4-3** through **-6**, as applicable	
17	Weathertight hatch covers and closing appliances	Leak[*3.7]	See **An-1.4.4-3** through **-6**, as applicable	Hatch covers closed by tarpaulins and battens excluded
18	Dual purpose tanks/dry cargo hatch covers	Leak[*3,7]	See **An-1.4.4-3** through **-6**, as applicable	In addition to structural test in item 6 or 7
19	Chain lockers	Leak and structural[*1]	Top of chain pipe	
20	L.O. sump. tanks and other similar tanks/spaces under main engines	Leak[*9]	See **An-1.4.4-3** through **-6**, as applicable	
21	Ballast ducts	Leak and structural[*1]	The greater of - ballast pump maximum pressure, or - setting of any pressure relief valve	
22	Fuel Oil Tanks	Leak and structural[*1]	The greater of - top of the overflow[*10], - to 2.4 *m* above top of tank[*2], or - to top of tank[*2] plus ~~setting of any~~ the design vapour pressure ~~relief valve~~, or - to bulkhead deck	
23	Fuel oil overflow tanks not intended to hold fuel	Leak and structural[*1]	The greater of - top of the overflow[*10], - to 2.4 *m* above top of tank[*2], or - to bulkhead deck	

Notes:

1 Refer to section **An-1.4.2-~~2~~3**.

2 The top of a tank is the deck forming the top of the tank, excluding any hatchways.

3 Hose Test may also be considered as a medium of the test. See **An-1.3.1-2**.

4 Including tanks arranged in accordance with the provisions of **6.1.1-3, Part C-~~of the Rules~~**.

5 Including duct keels and dry compartments arranged in accordance with the provisions of **6.1.1-3, Part C-~~of the Rules~~**, and/or oil fuel tank protection and pump room bottom protection arranged in accordance with the provisions of **1.2.3** and **3.2.5, Part 3, ~~of~~ the Rules for Marine Pollution Prevention Systems** respectively.

6 Where water tightness of a watertight door has not been confirmed by prototype test, testing by filling watertight spaces with water is to be carried out. See **13.3.3-1, Part C-~~of the Rules~~**.

7 As an alternative to the hose testing, other testing methods listed in **An-1.4.4-7** through **-9** may be applicable subject to adequacy of such testing methods being verified. For watertight bulkheads (item 11.1) alternatives to the hose testing may only be used where a hose test is not practicable.

8 A "Leak and structural test", see **An-1.4.2-~~2~~3** is to be carried out for a representative cargo hold if intended for in-port ballasting. The filling level requirement for testing cargo holds intended for in-port ballasting is to be the maximum loading that will occur in-port as indicated in the loading manual.

9 Where L.O. sump tanks and other similar spaces under main engines intended to hold liquid form part of the watertight subdivision required to satisfy the damage stability requirements of the ship, they are to be tested as per the requirements of Item 5, Deep tanks other than those listed elsewhere in this table.

10 Refer to section **An1.3.1-3**.

~~10~~11 Tests of piping systems in each part of the ship are to be carried out as specified in **12.6, 13.17**, and **14.6, Part D-~~of the~~**

~~Rules~~.

Table An 1.4-2 has been amended as follows.

Table An~~-~~1.4-2 Additional Test Requirements for Special Service Ships/Tanks

	Type of Ship/Tank	Structures to be tested	Type of Test	Test Head or Pressure	Remarks
1	Liquefied gas carriers	Integral tanks	Leak and structural	Refer to **Part N~~-of the Rules~~**	
		Hull structure supporting membrane or semi-membrane tanks	Refer to **Part N ~~of the Rules~~**	Refer to **Part N~~-of the Rules~~**	
		Independent tanks type A	Refer to **Part N ~~of the Rules~~**	Refer to **Part N~~-of the Rules~~**	
		Independent tanks type B	Refer to **Part N ~~of the Rules~~**	Refer to **Part N~~-of the Rules~~**	
		Independent tanks type C	Refer to **Part N ~~of the Rules~~**	Refer to **Part N~~-of the Rules~~**	
2	Edible liquid tanks	Independent tanks	Leak and structural[*1]	The greater of - top of the overflow[*5], or - to 0.9 *m* above top of tank[*2]	
3	Chemical carriers	Integral or independent cargo tanks	Leak and structural[*1,4]	The greater of - to 2.4 *m* above top of tank[*2*3], or - to top of tank[*2] plus ~~setting of any~~ the design vapour pressure ~~relief valve~~	Where a cargo tank is designed for the carriage of cargoes with specific gravities larger than 1.0, ~~an appropriate additional head is to be considered~~[*3] see **An 1.4.4-1**

Notes:

1 Refer to Section **An~~=~~1.4.2-~~2~~3**.

2 Top of tank is deck forming the top of the tank excluding any hatchways.

3 For gravity tanks that are to be loaded with cargoes having a cargo density exceeding 1.0, a hydrostatic test is to be carried out with a head of water to the height obtained from the following formula above the top of the tank.

$\frac{H}{2}(\gamma - 1) + 2.4 \ (m)$

H : Vertical distance measured from the lower edge of the bulkhead plate of the tank to the top of the tank (m)

γ : Density of cargoes loaded in the tank.

Where L exceeds 150 m, or H is exceptionally large in comparison with L, the manner of the hydrostatic test is to be considered by the Society.

4 For pressure tanks, these tests are to be carried out in accordance with **4.23.6, Part N~~-of the Rules~~**. In applying **4.23.6, Part N~~-of the Rules~~**, "design vapour pressure" is to be read as "design pressure~~-~~".

5 Refer to section **An1.3.1-3**.

Title of Chapter 2 has been amended as follows.

Chapter 2 SHIPS ~~OTHER THAN THOSE~~ SUBJECT TO *SOLAS CONVENTION* ~~EXEMPTION~~ EXEMPT/EQUIVALENT ~~AS SPECIFIED IN CHAPTER 1~~

An2.1 General

An2.1.1 General

Sub-paragraph -2 has been amended as follows.

1 The test procedures specified in this Annex are to confirm the watertightness of tanks and watertight boundaries as well as the structural adequacy of tanks which make up the watertight subdivisions of ships. These procedures may also be applied to verify the weathertightness of structures and shipboard outfitting. The tightness of all tanks and watertight boundaries of ships being newly constructed and ships undergoing major conversions or major repairs is to be confirmed by these test procedures prior to the delivery of the ship. "Major repairs" refers to repairs affecting the tightness of watertight boundaries.

2 Testing procedures of watertight compartments are to be carried out in accordance with **Chapter 2, ~~of~~ Annex 2.1.5 "Testing Procedures of Watertight Compartments"** for ~~ships not subject to *SOLAS Convention* and~~ ships subject to *SOLAS Convention* (including ships subject to **Part CSR-B&T**) for which:

(1) the shipyard provides documentary evidence of the shipowner's agreement to a request to the Flag Administration for an exemption from the application of *SOLAS Chapter II-1*, *Regulation 11*, or for an equivalency agreeing that the content of **Chapter 2, ~~of~~ Annex 2.1.5 "Testing Procedures of Watertight Compartments"** is equivalent to *SOLAS Chapter II-1*, *Regulation 11*; and

(2) the above-mentioned exemption/equivalency has been granted by the responsible Flag Administration.

An2.2 Application

Paragraph An2.2.1 has been amended as follows.

An2.2.1 Application

1 Testing procedures are to be carried out in accordance with the requirements of **Chapter 1** of this Annex in association with the following alternative procedures specified in **-2** to **-~~6~~7** for **An 1.4.2-~~23~~ and ~~Table An1.4-1~~**.

2 The tank boundaries are to be tested from at least one side. The tanks for structural test are to be selected so that all representative structural members are tested for the expected tension and compression.

3 Structural tests are to be carried out for at least one tank of a group of tanks having structural similarity (i.e. same design conditions, alike structural configurations with only minor localised differences determined to be acceptable by the attending Surveyor) on each vessel provided all other tanks are tested for leaks by an air test. The acceptance of leak testing using an air test instead of a structural test does not apply to cargo space boundaries adjacent to other compartments in tankers and combination carriers or to the boundaries of tanks for segregated cargoes or pollutant cargoes in other types of ships.

4 Additional tanks may require structural testing if found necessary after the structural testing of

the first tank.

5 For tanks which are less than 2 m3 in volume, structural testing may be replaced by leak testing.

~~5~~6 Where the structural adequacy of the tanks and spaces of a vessel were verified by the structural testing required ~~in Table An1.4-1 of~~ by either **Chapter 1** or **-3** above, subsequent vessels in the series (i.e. sister ships built from the same plans at the same shipyard) may be exempted from structural testing of tanks, provided that:

(1) Water-tightness of boundaries of all tanks ~~is~~ and spaces is verified by leak tests and thorough inspections are carried out.

(2) Structural testing is carried out for at least one tank or space of each type among all tanks/spaces of each sister vessel.

(3) Additional tanks and spaces may require structural testing if found necessary after the structural testing of the first tank or if deemed necessary by the attending Surveyor.
For cargo space boundaries adjacent to other compartments in tankers and combination carriers or boundaries of tanks for segregated cargoes or pollutant cargoes in other types of ships, ~~the provisions of -3 above are to apply in lieu of preceding (2)~~ structural tests are to be carried out for at least one tank of a group of tanks having structural similarity (i.e. same design conditions, alike structural configurations with only minor localised differences determined to be acceptable by the attending Surveyor) on each vessel provided all other tanks are tested for leaks by an air test.

~~6~~7 Sister ships built (i.e. keel laid) two years or more after the delivery of the last ship of the series, may be tested in accordance with ~~-5~~**6** above at the discretion of the Society, provided that:

(1) ~~g~~General workmanship has been maintained (i.e. there has been no discontinuity of shipbuilding or significant changes in the construction methodology or technology at the yard, shipyard personnel are appropriately qualified and demonstrate an adequate level of workmanship as determined by the Society) and:

(2) ~~a~~An NDT plan is implemented and evaluated by the Society for the tanks not subject to structural tests. Shipbuilding quality standards for the hull structure during new construction are to be reviewed and agreed during the kick-off meeting. ~~Structural fabrication is to be carried out in accordance with *IACS Recommendation No.47*, "*Shipbuilding and Repair Quality Standard*", *JSQS* or a recognised fabrication standard which has been accepted by the Society prior to the commencement of fabrication/construction.~~ The work is to be carried out in accordance with the Rules and under survey of the Society.

Chapter 3 has been added as follows.

Chapter 3 SHIPS NOT SUBJECT TO *SOLAS CONVENTION*

An3.1 General

An3.1.1 General

1 The test procedures specified in this Annex are to confirm the watertightness of tanks and watertight boundaries as well as the structural adequacy of tanks which make up the watertight subdivisions of ships. These procedures may also be applied to verify the weathertightness of structures and shipboard outfitting. The tightness of all tanks and watertight boundaries of ships being newly constructed and ships undergoing major conversions or major repairs is to be confirmed by these test procedures prior to the delivery of the ship. "Major repairs" refers to repairs affecting the tightness of watertight boundaries.

2 Testing procedures of watertight compartments are to be carried out in accordance with **Chapter 3, Annex 2.1.5 "Testing Procedures of Watertight Compartments"** for ships not subject to *SOLAS Convention*.

An3.2 Application

An3.2.1 Application

1 Testing procedures are to be carried out in accordance with the requirements of **Chapter 1** of this Annex in association with the following alternative procedures specified in **-2** to **-8** for **An1.4.2-3.**

2 The tank boundaries are to be tested from at least one side. The tanks for structural test are to be selected so that all representative structural members are tested for the expected tension and compression.

3 The requirements given in **Table An1.4-1** of **Chapter 1** for structurally testing tanks at 2.4 *m* above the top of the tank do not apply. Instead, the minimum test pressure for structural testing is to be taken as $0.3D + 0.76$ *m* above the top of the tank where the top of the tank is the deck forming the top of the tank, excluding any hatchways and *D* is the depth of the ship. The minimum test pressure need not be taken greater than 2.4 *m* above the top of the tank.

4 Structural tests are to be carried out for at least one tank of a group of tanks having structural similarity (i.e. same design conditions, alike structural configurations with only minor localised differences determined to be acceptable by the attending Surveyor) on each vessel provided all other tanks are tested for leaks by an air test. The acceptance of leak testing using an air test instead of a structural test does not apply to cargo space boundaries adjacent to other compartments in tankers and combination carriers or to the boundaries of tanks for segregated cargoes or pollutant cargoes in other types of ships.

5 Additional tanks may require structural testing if found necessary after the structural testing of the first tank.

6 For tanks which are less than 2 m^3 in volume, structural testing may be replaced by leak testing.

7 Where the structural adequacy of the tanks and spaces of a vessel were verified by the structural testing required by either **Chapter 1** or **-4** above, subsequent vessels in the series (i.e. sister ships built from the same plans at the same shipyard) may be exempted from structural testing of tanks, provided that:

(1) Water-tightness of boundaries of all tanks and spaces are verified by leak tests and thorough inspections are carried out.

(2) Structural testing is carried out for at least one tank or space among all tanks/spaces of each

sister vessel.

(3) Additional tanks and spaces may require structural testing if found necessary after the structural testing of the first tank or if deemed necessary by the attending Surveyor.

For cargo space boundaries adjacent to other compartments in tankers and combination carriers or boundaries of tanks for segregated cargoes or pollutant cargoes in other types of ships, structural tests are to be carried out for at least one tank of a group of tanks having structural similarity (i.e. same design conditions, alike structural configurations with only minor localised differences determined to be acceptable by the attending Surveyor) on each vessel provided all other tanks are tested for leaks by an air test.

8 Sister ships built (i.e. keel laid) two years or more after the delivery of the last ship of the series, may be tested in accordance with -7 above at the discretion of the Society, provided that:

(1) General workmanship has been maintained (i.e. there has been no discontinuity of shipbuilding or significant changes in the construction methodology or technology at the yard, shipyard personnel are appropriately qualified and demonstrate an adequate level of workmanship as determined by the Society) and:

(2) An NDT plan is implemented and evaluated by the Society for the tanks not subject to structural tests. Shipbuilding quality standards for the hull structure during new construction are to be reviewed and agreed during the kick-off meeting. The work is to be carried out in accordance with the Rules and under survey of the Society.

Part C HULL CONSTRUCTION AND EQUIPMENT

Chapter 4 LOADS

4.4 Loads to be Considered in Local Strength

4.4.3 Testing Condition

4.4.3.2 Internal Pressure

Table 4.4.3-2 has been amended as follows.

Table 4.4.3-2 Design Testing Water Head Height z_{ST}

Compartment	z_{ST}
Double bottom tanks(1)	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{bd})$(3)
Double side tanks	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{bd})$(3)
Deep tanks not described in this Table	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4)$(3)
Cargo oil tanks	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{top} + z_{PV})$(3)
Ballast holds of bulk carriers	$z_{ST} = z_{hc}$
Peak tanks (fore and aft peak tanks)	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4)$(3)
Chain lockers	$z_{ST} = z_c$
Ballast ducts	$z_{ST} = \max(z_{bp}, z_{PV})$
Fuel oil tanks	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{top} + z_{PV}, z_{bd})$(3)
Cargo tanks of ships carrying dangerous chemicals in bulk(2)	$z_{ST} = \max(z_{top} + 2.4, z_{top} + z_{PV})$(3)
Cargo tanks of ships carrying liquefied gas in bulk	According to **Part N**
Low-flashpoint fuel tanks for storing natural gas	According to **Part GF**
Edible liquid tanks (independent tanks)	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 0.9)$
Fuel oil overflow tanks not intended to hold fuel	~~$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{bd})$~~(3)

Notes:
z_{top}: Z coordinate of the top of tank (m) (the highest point of the tank excluding small hatchways)
z_{bd}: Z coordinate of the bulkhead deck (m)
z_{PV}: Z coordinate of the test water head (m) corresponding to ~~set~~ the design vapour pressure ~~of pressure relief valve~~
z_{hc}: Z coordinate of the top of hatch coaming (m)
z_c: Z coordinate of the top of chain pipe (m)
z_{bp}: Z coordinate of the test water head (m) corresponding to maximum pressure of ballast pump
h_{air}: Height of the air pipe or overflow pipe (m) above the top of the tank

(1) For double bottom tanks connected with hopper side tanks, topside tanks or double side tanks, z_{ST} corresponding to "hopper side tanks, topside tanks, double side tanks, fore and aft peaks used as tanks, and cofferdams" is applicable.

(2) For tanks loaded with cargoes having specific gravity exceeding 1.0, an additional water head in accordance with *Note*3, Table An1.4-2, Annex B2.1.5 Part B* is to be considered.

(3) For ships not subject to *SOLAS Convention*, "0.3D + 0.76, but not greater than 2.4" can be used instead of "2.4", where D is the depth of the ship (m).

4.6 Loads to be Considered in Strength Assessment by Cargo Hold Analysis

4.6.4 Testing Condition

4.6.4.3 Internal Pressure

Table 4.6.4-2 has been amended as follows.

Table 4.6.4-2 Design Testing Water Head Height z_{ST}

Compartment	z_{ST}
Double bottom tanks(1)	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{bd})$(3)
Double side tanks	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{bd})$(3)
Deep tanks not described in this Table	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4)$(3)
Cargo oil tanks	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{top} + z_{PV})$(3)
Ballast holds of bulk carriers	$z_{ST} = z_{hc}$
Peak tanks (fore and aft peak tanks)	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4)$(3)
Chain lockers	$z_{ST} = z_c$
Ballast ducts	$z_{ST} = \max(z_{bp}, z_{PV})$
Fuel oil tanks	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{top} + z_{PV}, z_{bd})$(3)
Cargo tanks of ships carrying dangerous chemicals in bulk(2)	$z_{ST} = \max(z_{top} + 2.4, z_{top} + z_{PV})$(3)
Cargo tanks of ships carrying liquefied gas in bulk	According to **Part N**
Low-flashpoint fuel tanks storing natural gas	According to **Part GF**
Edible liquid tanks (independent tanks)	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 0.9)$
Fuel oil overflow tanks not intended to hold fuel	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{bd})$(3)

Notes:
z_{top}: Z coordinate of the top of tank (m) (highest point of tank excluding small hatchways)
z_{bd}: Z coordinate of the bulkhead deck (m)
z_{PV}: Z coordinate of the test water head (m) corresponding to ~~set~~ the design vapour pressure ~~of pressure relief valve~~
z_{hc}: Z coordinate (m) at the top of the hatch coaming
z_c: Z coordinate (m) at the top of chain pipe
z_{bp}: Z coordinate of the test water head (m) corresponding to maximum pressure of ballast pump
h_{air}: Height of the air pipe or overflow pipe (m) above the top of the tank

(1) For double bottom tanks connected with "hopper side tanks, topside tanks or double side tanks, z_{ST} corresponding to hopper side tanks, topside tanks, double side tanks, fore and aft peaks used as tanks, and cofferdams" is applicable.

(2) For tanks to be loaded with cargoes having specific gravity exceeding 1.0, an additional water head in accordance with *Note*3, Table An1.4-2, Annex B2.1.5 Part B* is to be considered.

(3) For ships not subject to *SOLAS Convention*, "0.3D + 0.76, but not greater than 2.4" can be used instead of "2.4", where D is the depth of the ship (m).

"Rules for high speed craft" has been partly amended as follows:

Part 2 CLASS SURVEYS

Chapter 2 CLASSIFICATION SURVEYS

2.1 Classification Survey during Construction

Paragraph 2.1.5 has been amended as follows.

2.1.5 Hydrostatic and Watertight Tests

In the Classification Survey during construction, hydrostatic tests, watertight tests, etc., are to be carried out in accordance with the following:

(1) Hull and equipment

~~(a)~~ Hydrostatic tests or watertight tests are to be carried out ~~after all work in connection with watertightness are completed but before painting,~~ in accordance with ~~the requirements specified in Table 2.2.1~~ **Annex B2.1.5** in **Part B of the Rules for the Survey and Construction of Steel Ships**.

~~(b) A part or all of the hose tests may be dispensed with at the discretion of the Society.~~

~~(c) Watertight tests may be replaced by airtight tests at the discretion of the Society, provided that certain tanks designated by the Society are to be subjected to hydrostatic tests specified in Table 2.2.1, afloat.~~

(2) Machinery

Hydrostatic, leakage or airtight tests are to be carried out as specified in each Chapter of **Part 9** in relation to the kind of machinery.

2.2 Classification Survey of Craft Not Built under Survey

Paragraph 2.2.2 has been amended as follows.

2.2.2 Hydrostatic and Watertight Tests

In the Classification Survey prescribed in **2.2.1**, sea trials are to be carried out after hydrostatic tests and watertight tests carried out in accordance with the requirements in the following **(1)** and **(2)**, machinery to be made in good order, working pressure of boilers to be determined, safety valves to be adjusted and accumulation tests of boilers to be carried out. Except hydrostatic tests of boilers and pressure vessels of which important parts have been newly repaired, main steam pipes, and air tanks of which interior can not be inspected, and tests for gas leakage of refrigerating machinery on board, tests and trials may be dispensed with at the discretion of the Society.

(1) Double bottoms, both peaks, tanks, cofferdams and chain lockers located abaft the collision bulkhead, watertight bulkheads and shaft tunnels are to be tasted as specified in ~~Table 2.2.1~~ **2.1.5(1)**.

(2) Hydrostatic, leakage or airtight tests are to be carried out as specified in each chapter in relation to the kind of machinery.

Table 2.2.1 has been deleted as follows.

~~Table 2.2.1 Hydrostatic Tests~~

~~No.~~	~~Tanks, spaces and so forth~~	~~Type of tests and their pressure/head~~	~~Notes~~
~~1~~	~~Double bottoms~~	~~Hydrostatic test with a head of water to the top of air pipe.~~	~~-~~
~~2~~	~~Deep tanks~~	~~Hydrostatic test with a head of water to the top of overflow pipe.~~	~~Where it is difficult to carry out the hydrostatic test on the berth with the specified test head, the test may be carried out at sea.~~
~~3~~	~~After peak and stern tube compartments~~	~~Hydrostatic test with a head of water to the load waterline. For parts above the load waterline, hose test with a pressure of water not less than 0.2 *MPa* in the hose.~~	~~Where they are used as tanks, tests as specified in Item 2 are to be carried out.~~
~~4~~	~~Fore peak~~		
~~5~~	~~Chain lockers located abaft the collision bulkhead~~	~~Hydrostatic test with a head of water to the top of chain lockers.~~	~~-~~
~~6~~	~~Shell plating~~	~~Hose test with a pressure of water not less than 0.2 *MPa* in the hose.~~	~~For shell plating corresponding to those of column No. 1 through No. 5, to be as specified in each corresponding column.~~
~~7~~	~~Watertight decks~~		~~For decks corresponding to those of column No. 2 through No. 5, to be as specified in each corresponding column.~~
~~8~~	~~Watertight bulkheads and recesses~~		~~When bounding deep tanks, fore peak, or after peak, to be as specified in each corresponding column.~~
~~9~~	~~Shaft tunnels and other watertight tunnels~~		
~~10~~	~~Hatchways with weathertight steel covers~~		~~To be tested in closed position.~~
~~11~~	~~Double plate rudders~~	~~Airtight test with a pressure of 0.05 *MPa*~~	~~-~~

~~Note:~~

~~Tests for the piping are to be as specified in 1.3.1(7), 1.3.2(11) and 1.3.2(13), Part 9 of the Rules.~~

Part 5 DESIGN LOADS

Chapter 2 DESIGN LOADS

2.6 Design Loads for Watertight Bulkheads and Deep Tanks

Paragraph 2.6.2 has been amended as follows.

2.6.2 Design Loads for Deep Tanks

The design loads for deep tanks (P_{DT}) are ~~not~~ to be ~~less than that~~ those obtained from the following ~~formula~~ formulae

(1) Sea Going Condition

$$P_{DT} = 10\rho C A_f h_D \quad (kN/m^2)$$

where:

ρ: The specific gravity of liquid which is intended to carry. However, where the value is less than 1, the specific gravity is to be taken 1.

C and A_f: As specified in **2.4.2** in this Chapter.

h_D: Vertical distance measured from the lower edge of the plates to the mid-point of the height between the top of tanks and the top of overflow pipes (m).

(2) Tank Test Condition

$$P_{DT} = 10 \cdot h_T \quad (kN/m^2)$$

where:

h_T: Test head specified in **Annex B2.1.5, Part B of the Rules for the Survey and Construction of Steel Ships** (m).

Part 6 SCANTLING DETERMINATION OF HULL CONSTRUCTION

Chapter 1 HULL CONSTRUCTION FOR STEEL OR ALUMINIUM ALLOYS CRAFT

1.5 Plating

1.5.3 Scantling Determination of Plating

Thickness of plating is not to be less than that obtained from the following formula.

$$\frac{QS\sqrt{P}}{\sqrt{\sigma_{all}}} + C \quad (mm)$$

Where:

Q : As given by following.
For watertight bulkhead plating=: 15.8
For other plating=: 22.4

S : Spacing of longitudinals or stiffeners (m)

P : Design load specified in **Table 6.1.4** corresponding to ~~a~~the kind of plating. Design loads specified in **Table 6.1.4** are to be in accordance with **Part 5** ~~of this Rule~~ (kN/m^2).

σ_{all} : Allowable stress specified in **Table 6.1.4** (kN/m^2)

C : Corrosion margin corresponding to the material used as given by following.
For steels=: 1.0 (mm)
For aluminium alloys=: 0 (mm)

Table 6.1.4 has been amended as follows.

Table 6.1.4 Design Load and Allowable Stress

	P	σ_{all}(1)
Bottom shell plating	P_B	$0.73\sigma_y$
Side shell plating	P_S	$0.73\sigma_y$
Deck plating	P_D	$0.73\sigma_y$
Deckhouse/superstructure bulkhead planting	P_H	$0.91\sigma_y$
Longitudinal watertight bulkhead planting	P_{WT}	$0.73\sigma_y$
Transverse watertight bulkhead planting	P_{WT}	$0.91\sigma_y$
Longitudinal deep tank bulkhead planting	P_{DT}	$0.73\sigma_y$(2)
Transverse deep tank bulkhead planting	P_{DT}	$0.91\sigma_y$(2)

Notes:

(1) σ_y is yield point or proof stress of the material used (N/mm^2)

(2) For tank test conditions of deep tanks, σ_{all} is to be $1.0\sigma_y$ (N/mm^2)

1.6 Longitudinals and Stiffeners

1.6.4 Scantling Determination of Longitudinals and Stiffeners

Section modulus of longitudinals and stiffeners is not to be less than that obtained from the following formula.

$\frac{83.3CSPl^2}{\sigma_{all}}$ (cm^3)

where:

C : Safety factor for corrosion as given by following.
For steels=: 1.1
For aluminium alloys=: 1.0

S : Spacing of longitudinals or stiffeners (m)

P : Design load specified in **Table 6.1.5** corresponding to ~~a~~the kind of longitudinals or stiffeners. Design loads specified in **Table 6.1.5** are to be in accordance with **Part 5** ~~of this Rule~~ (kN/m^2).

l : Span measured between the adjacent supports of stiffeners including the length of connection (m). Where girders are provided, l is the distance from the heel of end connection to the first girders or the distance between the girders.

σ_{all} : Allowable stress specified in **Table 6.1.5** (kN/m^2)

Table 6.1.5 has been amended as follows.

Table 6.1.5 Design Load and Allowable Stress

	P	σ_{all} (1)
Bottom longitudinals	P_B	$0.73\sigma_y$
Bottom frames	P_B	$0.91\sigma_y$
Side longitudinals	P_S	$0.73\sigma_y$
Side frames	P_S	$0.91\sigma_y$
Longitudinal beams	P_D	$0.73\sigma_y$
Transverse beams	P_D	$0.91\sigma_y$
Stiffeners fitted on deckhouse/superstructure bulkheads	P_H	$0.91\sigma_y$
Longitudinals fitted on watertight bulkheads	P_{WT}	$0.73\sigma_y$
Stiffeners fitted on watertight bulkheads	P_{WT}	$0.91\sigma_y$
Longitudinals fitted on deep tank bulkheads	P_{DT}	$0.73\sigma_y$ (2)
Stiffeners fitted on deep tank bulkheads	P_{DT}	$0.91\sigma_y$ (2)

Notes:

(1) σ_y is yield point or proof stress of the material used (N/mm^2)

(2) For tank test conditions of deep tanks, σ_{all} is to be $1.0\sigma_y$ (N/mm^2)

1.7 Girders

1.7.1 Scantling Determination of Girders

1 Section modulus of girders supporting longitudinals or stiffeners is not to be less than that obtained from the following formula.

$$\frac{mCSPl^2}{\sigma_{all}} \ (cm^3)$$

Where:

m : Coefficient as given in **Table 6.1.8**, according to the boundary condition of end connection.

C : Safety factor for corrosion as given by following.

For steels=: 1.1

For aluminium alloys=: 1.0

S : Breadth of the area supported by the girder (m)

P : Design load specified in **Table 6.1.7** corresponding to ~~a~~the kind of girders. Design loads specified in **Table 6.1.7** are to be in accordance with **Part 5** ~~of this Rule~~ (kN/m^2).

l : Span measured between the adjacent supports of girders (m).

σ_{all} : Allowed stress specified in **Table 6.1.7**.

2 Web sectional area of girder supporting stiffener is not less than the value obtained from the following formula.

$$\frac{nCSPl}{\tau_{all}} \ (cm^2)$$

where:

n : Coefficient as given in **Table 6.1.8**, according to the boundary condition of end connection.

C, S, l and P : As specified in preceding **-1**.

τ_{all} : Allowed stress specified in **Table 6.1.7**.

Table 6.1.7 has been amended as follows.

Table 6.1.7 Design Load and Allowable Stress

	P	σ_{all}(1)	τ_{all}(1)
Bottom girders	P_B	$0.73\sigma_y$	$0.42\sigma_y$
Bottom transverses	P_B	$0.91\sigma_y$	$0.53\sigma_y$
Side stringers	P_S	$0.73\sigma_y$	$0.42\sigma_y$
Wed frames	P_S	$0.91\sigma_y$	$0.53\sigma_y$
Deck girders	P_D	$0.73\sigma_y$	$0.42\sigma_y$
Deck transverses	P_D	$0.91\sigma_y$	$0.53\sigma_y$
Girders and transverses fitted on deckhouse/ superstructure bulkheads	P_H	$0.91\sigma_y$	$0.53\sigma_y$
Girders fitted on watertight bulkheads	P_{WT}	$0.73\sigma_y$	$0.42\sigma_y$
Transverses fitted on watertight bulkheads	P_{WT}	$0.91\sigma_y$	$0.53\sigma_y$
Girders fitted on deep tank bulkheads	P_{DT}	$0.73\sigma_y$(2)	$0.42\sigma_y$(3)
Transverses fitted on deep tank bulkheads	P_{DT}	$0.91\sigma_y$(2)	$0.53\sigma_y$(3)

Notes:

(1) σ_y is yield point or proof stress of the material used (N/mm^2)

(2) For tank test conditions of deep tanks, σ_{all} is to be $1.0\sigma_y$ (N/mm^2)

(3) For tank test conditions of deep tanks, τ_{all} is to be $0.58\sigma_y$ (N/mm^2)

"Guidance for the survey and construction of ships of fibreglass reinforced plastics" has been partly amended as follows:

Chapter 2 CLASS SURVEYS

Section 2.1 has been deleted as follows.

~~**2.1 General**~~

~~**2.1.1 General**~~

~~The head pressure in the hydrostatic test of deep tanks of *FRP* ships of less than 20 *m* in length may be of the height up to positions of tops of overflow pipes.~~