U.S. Department of Transportation

**United States Coast Guard**

# Load Line Technical Manual

This copy of the "Load Line Technical Manual" has been annotated to reflect the 2005 revisions to the International Convention on Load Lines (ICLL). Except where stated otherwise, all ICLL revisions apply to new U.S. vessels (i.e., keels laid on/after 1 January 2005) that are seeking either an international (ICLL) or unrestricted domestic (US) load line certificate.

**American Bureau of Shipping**

# CHAPTER I

This document is available to the public through the National Information and Technical Service, Springfield, Virginia 22161

Office of Marine Safety, Security and Environmental Protection

Washington, D.C. 20593

December 1990
Final Report

**USCG-M-1-90**

# Load Line Technical Manual

## CHAPTER I

## GENERAL ITEMS

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## Preface to the electronic version

*November 6, 2003*

In 1990, the U.S. Coast Guard commissioned the American Bureau of Shipping (ABS) to prepare a report that integrated U.S. load line regulations & policies, ABS and IACS interpretations, IMO circulars, and the International Convention on Load Lines (ICLL) into a single reference document.

This *"Load Line Technical Manual"* is the result of that effort. It sets forth the technical procedures for evaluating, calculating and assigning ICLL load lines, using USCG and ABS policies where the Convention leaves certain requirements "to the satisfaction of the Administration" or is open to interpretation. This manual applies to U.S. vessels seeking an international ICLL assignment or a domestic U.S. load line assignment for unrestricted voyages by sea; it does not cover U.S. load line regulations for other types of domestic voyages (such as coastwise or Great Lakes).

This electronic version of the manual has been divided into five *Adobe .pdf* files:

| | |
|---|---|
| *LL Tech Manual-ToC.pdf* | Table of Contents |
| *LL Tech Manual-Ch1.pdf* | Chapter I, General Items |
| *LL Tech Manual-Ch2.pdf* | Chapter II, Load Line Calculation |
| *LL Tech Manual-Ch3.pdf* | Chapter III, Cond of Assignment-Minimum Freebrd |
| *LL Tech Manual-Ch4.pdf* | Chapter IV, Cond of Assignment-Increased Freebrd |

This Technical Manual was originally prepared in 1990; therefore, it only incorporates material up to that time. Since then, there has been further evolution of load line policies, additional IACS interpretations, new IMO Circulars, etc. The ICLL itself has been amended by the 1988 Protocol (which entered into force on February 3, 2000) as well as subsequent amendments that were adopted in 2003 (and will enter into force on 1 January 2005). There are no immediate plans to incorporate these into this manual.

## Preface to the annotated version

*February 3, 2006*

On January 1, 2005, numerous new and revised ICLL regulations entered into force, adding new technical requirements or expanding existing requirements to encompass shipboard arrangements not previously addressed. The amendments also incorporate (wholly or partially) more than 35 IACS Unified Interpretations on the Load Line Convention.

In response to these revisions, this annotated version of the *Load Line Technical Manual* has been corrected, but not updated. Annotations have been inserted only where the ICLL revisions have affected the original *LLTM* discussion or policy *(the affected text is boxed)*. However, there are many other ICLL revisions that are not indicated in this annotated version. Readers are advised to consult an officially-published copy of the ICLL in conjunction with this annotated version. IMO publications can be ordered via the IMO website at *www.imo.org*.

Unless stated otherwise in this annotated version, all revisions apply to new U.S. vessels (the keels of which were laid on/after January 1, 2005) seeking an international (ICLL) or unrestricted domestic (US) load line certificate.

Future annotations will be added whenever revised ICLL regulations affect the technical content of this *Manual*.

# ABBREVIATIONS and VARIABLES

| | |
|---|---|
| **A** | Minimum req'd freeing port area; or |
| | Angle in freeing port calculation for deck sheathing |
| **Aa** | Actual area of freeing port |
| **Ae** | Effective area of freeing port |
| **AB** | American Bureau of Shipping |
| $\mathbf{A_h}$ | Actual height of freeing port opening |
| **ABP** | Bow planform area used in the bow height trim resistivity calculation |
| **ABS** | American Bureau of Shipping |
| **AP** | After Perpendicular |
| **b** | Breadth of superstructure at the middle of its length; *or* |
| *b* | Average breadth of deck obstruction; or |
| | Breadth of a local well in the freeboard deck |
| $\mathbf{b_1}$ | Breadth of extension at superstructure end bulkhead; *or* |
| | Breadth of recess at midpoint of its length |
| $b_1$ | Average breadth of deck obstruction No. 1 |
| $b_2$ | Average breadth of deck obstruction No. 2 |
| $b_b$ | Average breadth of deck bin |
| $\mathbf{b_4}$ | Half breadth of second recess at the midpoint of its length |
| **B** | Breadth as defined in the ICLL |
| *B* | Angle used in freeing port calc for non-flush openings |
| $\mathbf{B_1}$ | Half breadth of superstructure at start of extension; *or* |
| | Breadth of superstructure at the midpoint of the recess |
| $\mathbf{B_4}$ | Half breadth of superstructure at midpoint of the length of the second recess |
| **B-60** | A Type 'B' freeboard that is reduced by 60% of the difference between a Type 'A' and a Type 'B' tabular freeboard |
| **B-100** | A Type 'B' freeboard that is reduced by 100% of the difference between a Type 'A' and a Type 'B' tabular freeboard |
| $B_b$ | Average breadth of the vessel in way of the well formed by a deck bin. |
| **Bhd** | Bulkhead |
| **Bs** | Breadth of the vessel at the mid-length of the superstructure |
| **C** | Camber |
| **C1** | Subdivision load line mark |
| **Cb** | Block coefficient |
| **Circ** | Circular |
| **CL** | Center line |
| **cm** | Centimeter(s) |

| | |
|---|---|
| Cor | Correction |
| D | Molded displacement; |
| | Molded depth |
| Dr | Depth of a local well in the freeboard deck |
| $d_1$ | 85% of the least molded depth |
| Df | Depth for freeboard |
| dk | Deck |
| E | Effective length of superstructure |
| f | Tabular freeboard |
| *f* | Freeing port area adjustment factor |
| $f_b$ | Freeing port area factor for bins |
| F | Minimum required freeing port area |
| $F_1$ | Freeing port area non-continuous deck obstruction |
| $F_2$ | Freeing port area - continuous deck obstruction |
| fbd | Freeboard |
| FFA | Free Flow Area |
| FP | Forward perpendicular |
| ft | Feet |
| FW | Fresh Water load line mark |
| GM | Metacentric Height |
| gt | Gross tons |
| h | Actual height of trunk |
| $h_1$ | Least height of superstructure |
| $h_b$ | Bulwark height in way of freeing port opening |
| $h_c$ | Actual trunk hatch coaming height |
| $h_i$ | Height of inboard end |
| $h_L$ | Least height of superstructure |
| $h_o$ | Height of lower edge of freeing port opening above the deck |
| $h_{rc}$ | Required trunk hatch coaming height |
| $h_s$ | Standard height of superstructure |
| IACS | International Association of Classification Societies |
| ICLL | International Convention on Load Lines |
| IMO | International Maritime Organization |
| in | Inch |
| ISO | International Standards Organization |
| ITB | Integrated Tug Barge |
| l | Length of deck sheathed area which extends from side to side; *or* |
| | Length of a local well in the fbd dk |
| *l* | Length of a well |

| | |
|---|---|
| $l'$ | Length of well for freeing port area determination |
| $l_1$ | Length of superstructure set-in from the side of the vessel; *or*<br>Length of recess |
| $l_1$ | Average length of deck obstruction No. 1 |
| $l_2$ | Equivalent length of superstructure in way of recess |
| $l_2$ | Average length of deck obstruction No. 2 |
| $l_4$ | Equivalent length of second recess |
| $l_c$ | Length of camber in the molded half breadth of the vessel |
| L | Length as defined in the ICLL |
| L' | The mean enclosed length of the poop or forecastle up to a maximum of 0.5L |
| LCF | Longitudinal center of floatation |
| LL | Load line |
| LLAC | Load Line Advisory Circular |
| LLC | Load Line Convention |
| m | Meter(s) |
| mm | Millimeter(s) |
| MSC | Marine Safety Center |
| NVIC | Navigation Vessel Inspection Circular |
| OCMI | Officer in Charge Marine Inspection |
| oz | Ounce |
| R | Coefficient used in the depth correction |
| Reg | Regulation |
| Rev | Revision |
| s | Sheer credit for excess height of a poop or forecastle |
| S | Mean length of superstructure; *or*<br>Summer load line mark |
| SLF | IMO Subcommittee on Stability and Load Lines and on Fishing Vessels safety |
| sp.gr | Specific gravity |
| Ss | Sheer strake thickness |
| Stab | Stability |
| Stbd | Starboard |
| Std | Standard |
| sw | Saltwater |
| T | Mean thickness of the exposed deck sheathing clear of deck openings; *or*<br>Tons per centimeter (inch) immersion in salt water at the molded summer load waterline; *or*<br>Tropical load line mark |
| TF | Tropical Fresh load line mark |

| | |
|---|---|
| US | United States |
| USA | United States of America |
| USCG | United States Coast Guard |
| V | Volume of the molded displacement of the vessel |
| W | Winter load line mark |
| WNA | Winter North Atlantic load line mark |
| WP | Waterplane |
| *x* | Distance lower edge of freeing port opening is above top of the deck sheathing |
| y | Difference between the actual and standard height of superstructure at the end of sheer |
| Z | Least difference between the actual and standard height of superstructure for sheer credit on a full superstructure vessel |

# REFERENCE SYSTEM

Footnotes are used throughout this manual to designate sources of information, and for notes to clarify or elaborate on the text given. The footnotes are placed on the bottom of the same page where the footnote reference mark appears.

## Reference Sources

The eleven (11) common reference sources are indicated on the "Reference Material" page. For simplification, the bracketed number [ ] that precedes each reference source listed is used in the footnotes throughout this manual in lieu of the complete title of the reference. The titles of other source material not listed on the "Reference Material" page are given in their entirety.

In certain instances the reference source given in the footnote may be followed by the word "(basis)", which means that the reference source was used as the basis of the text, however the wording has been changed or expanded for clarification.

## Footnote Reference Mark Location

The footnote reference mark is placed in the subject heading if the entire subject is taken from the reference source, and in the paragraph heading if the entire paragraph is taken from the source referenced. Reference marks placed at the end of a sentence generally mean that only that particular sentence is from the source referenced.

## Regulation Reference

The term "Regulation" or simply "Reg." used throughout this manual refers to the *International Convention on Load Lines,1966* unless otherwise specified.

## REFERENCE MATERIAL


[1] International Convention on Load Lines, 1966

[2] Code of Federal Regulations, Title 46, 1984

[3] Marine Safety Manual

[4] IMO Correspondence

[5] IACS Unified Interpretations of the International Convention on Load Lines, 1966

[6] U.S.C.G. Navigation and Vessel Inspection Circulars

[7] A.B.S. Circular Letters of Instruction

[8] U.S.C.G. Correspondence

[9] A.B.S. Correspondence

[10] Ship Design and Construction

[11] U.S.C.G. Load Line Advisory Circulars

# DEFINITION OF TERMS

## DEFINITIONS

New ICLL Reg 2-1 requires that "recognized organizations" comply with IMO resolutions A.737(18) and A.789(19), as amended.

**Amidships**

Amidships is at the middle of the length (L).

**Approved**[1]

Means approved by the Commandant, U.S. Coast Guard, unless otherwise stated.

**Assigning Authority**[2]

This term means the American Bureau of Shipping or such other recognized classification society which the Commandant may approve as the load line assigning and issuing authority for a vessel.

**Barge**

A non-propelled vessel.

**Commandant**

Means the Commandant, U.S. Coast Guard, Department of Transportation, Washington, D.C. 20593.[3]

**Conditions of Assignment**

Conditions that a vessel must meet to be eligible for the assignment of a load line.

**Contracting Government**

A government which is signatory to the International Convention on Load Lines, 1966.

**Convention**

In this manual , Convention refers to the International Convention on Load Lines, 1966.

[1] [2] 42.05-1
[2] [2] 42.05-1
[3] [2] 42.05-20

**Existing Ship**[4]

A vessel which is not a new vessel. An existing vessel is a vessel the keel of which is laid, or at a similar stage of construction, prior to July 21, 1968.

**Fishing Vessel**[5]

A vessel that commercially engages in the catching, taking or harvesting of fish or an activity that can reasonably be expected to result in the catching, taking or harvesting of fish.

**Fishing Processing Vessel** [6]

A vessel that commercially prepares fish or fish products other than by gutting, decapitating, gilling, skinning, shucking, icing, or brine chilling.

**Fish Tender Vessel**[7]

A vessel that commercially supplies, stores, refrigerates, or transports fish, fish products, or materials directly related to the fishing, or the preparation of fish to or from a fishing, fish processing, or fish tender vessel or a fish processing facility.

**Flush Deck Vessel**[8]

A flush deck vessel is one which has no superstructure on the freeboard deck, it may have sheer and or camber.

**Freeboard**[9]

Distance measured vertically downward amidships from the upper edge of the deck line to the upper edge of the related load line.

**Great Lakes**[10]

This term means the Great Lakes of North America. The waters of the St. Lawerence River west of a rhumb line drawn from Cap de Rosiers to West Point, Anticosti Island, and west of a line along 63° W. longitude from Anticosti Island to the north shore of the St. Lawerence River is considered part of the Great Lakes.

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4 [2] 42.05-30
5 [8] Electronic Message ABS5, 16 April 1986
6 [8] Electronic Message ABS5, 16 April 1986
7 [8] Electronic Message ABS5, 16 April 1986
8 [1] Reg. 3(11)
9 [1] Reg. 3(8)
10 [2] 42.05-40

Original ICLL Reg 3(11) has been redesignated as Reg 3(12)

### International Voyage[11]

A sea voyage from a country to which the present Convention applies to a port outside such country, or conversely. For this purpose, every territory for the international relations of which a Contracting Government is responsible or for which the United Nations are the administering authority is regarded as a separate country.

Vessels which are navigating solely on the Great Lakes are not considered on an international voyage. The Commonwealth of Puerto Rico, the Territory of Guam, the Virgin Islands, and all possessions and lands held by the United States under a protectorate or mandate shall be considered to be a territory of the United States.

### Machinery Space[12]

The machinery space is to be taken as extending from the top of the keel to the top of the freeboard deck and between the extreme main transverse bulkheads bounding the spaces containing the main and auxiliary propelling machinery, including the boilers serving the needs of propulsion.

### Merchant Vessel[13]

The definition of a merchant vessel for load line purposes is no longer used in United States law.

### Moonpool[14]

A moonpool is a watertight well in the main/upper deck, extending down through the hull and through the shell bottom, thus having direct communication with the sea resulting in a permanent loss of buoyancy for the portion of the moonpool below the waterline.

### New Ship[15]

A vessel whose keel is laid, or which is at a similar stage of construction, on or after July 21, 1968.

This definition applies to all vessels of countries signatory to or acceeding to the 1966 Convention prior to April 21, 1968, and to vessels not adhering to an applicable Convention as indicated in Article 16(4) of the 1966 Convention.

For countries which accede to the 1966 Convention after April 21, 1968, a "new vessel" (foreign) shall be one whose keel is constructively laid 3 months after the date of accedence.

The 2005 revisions to the ICLL went into force on 1 January 2005, and apply to all new U.S. and foreign vessels (i.e., keels laid on/after that date) that are issued an international (ICLL) load line certificate.

Except where stated otherwise, all ICLL revisions also apply to new U.S. vessels that are seeking an unrestricted domestic (US) load line certificate.

[11] [2] 42.05-45
[12] 1974 SOLAS Convention, Reg.2(h) {basis}
[13] [3] Vol. IV, Sec. 6.F.3.n
[14] [4] SLF 30/17/5
[15] [2] 42.05-50

**Perpendiculars**[16]

The forward and after perpendiculars are to be taken at the forward and after ends of the length (L). The forward perpendicular is to coincide with the foreside of the stem on the waterline on which the length is measured.

**Position 1**[17]

Upon the exposed freeboard and raised quarter decks, and upon exposed superstructure decks situated forward of a point located a quarter of the ship's length from the forward perpendicular.

Revised ICLL Reg 13 further clarifies Position 2 with respect to exposed superstructure decks.

**Position 2**

Upon exposed superstructure decks situated abaft a quarter of the ship's length from the forward perpendicular.

**Recognized Classification Society**[18]

The term "recognized classification society" refers to the American Bureau of Shipping or other classification society recognized by the Commandant, and who may also be approved as a load line assigning and issuing authority.

**Ship(s) and Vessel(s)**[19]

The terms "ship(s)" and "vessel(s)" are inter-changeable and synonymous words, and include every description of watercraft, other than a seaplane on the water, used or capable of being used as a means of transportation on water.

**Stringer Plate**

For load line purposes, the stringer plate is the outboard plate of the freeboard deck at amidships.

**Surveyor**[20]

The term "surveyor" means any person designated by the American Bureau of Shipping or other classification society recognized by the Commandant as the person who actually examines the vessel and/or materials associated with such examination, and who ascertains such vessel complies with the applicable load line requirements.

SUPERSTRUCTURE DECK
New ICLL Reg 3(11) adds the following definition: "A superstructure deck is a deck forming the upper boundary of a superstructure."

16 [1] Reg. 3(2)
17 [1] Reg. 13
18 [2] 42.05-60
19 [2] 42.05-63
20 [2] 42.05-65

**Watertight**[21]

Capable of preventing the passage of water through the structure in any direction under a head of water for which the surrounding structure is designed.

**Weathertight**[22]

Weathertight means that in any sea conditions water will not penetrate into the vessel.

**Well**[23]

A well is an uncovered opening in the deck that does not extend through the bottom of the vessel, thus not having direct communication with the sea and no loss of buoyancy for the well. A well could also be called a deck recess.

[21] International Conference on Fishing Vessel Safety, 1977
[22] [1] Reg. 3(12)
[23] [4] SLF 30/17/5

Original ICLL Reg 3(12) has been redesignated as Reg 3(13)

# APPLICATION AND EXCEPTIONS

## APPLICATION

The 2005 revisions to the ICLL went into force on 1 January 2005, and apply to all new U.S. and foreign vessels (i.e., keels laid on/after that date) that are issued an international (ICLL) load line certificate.

Except where stated otherwise, all ICLL revisions also apply to new U.S. vessels that are seeking an unrestricted domestic (US) load line certificate.

### U.S. Flag Vessels[1]

All U.S. flag vessels which engage in foreign voyages or international voyages by sea (other than solely on the Great Lakes) are required to have a load line except those types addressed under "exceptions." Unregistered vessels flying the flag of the United States are included in the term "all U.S. flag vessels "[2]

U.S. flag vessels authorized to engage in foreign or international voyages may also engage in domestic voyages by sea without additional load line marks and certificates.

### Foreign Vessels

All new and existing foreign merchant vessels, except those addressed under "exceptions":

(a) loading at or proceeding from any port or place within the jurisdiction of the United States or its possessions for a foreign voyage by sea, or;

(b) arriving within the jurisdiction of the United States or its possessions from a foreign voyage by sea;

are required to have a valid load line certificate.[3]

### Form "B" Load Lines[4]

The only load line certificates recognized by the U.S. on foreign vessels are those required by the Convention.[5] Article 17 of the Convention prohibits the issuance of a 1966 International Load Line Certificate to any vessel which flying the flag of a State, the government of which is not a contracting government to the Convention. Therefore, each vessel which flies the flag of a country not signatory to the Convention is subject to U.S. load line regulations

1 [2] 42.03-5
2 [1] Article 4(1) {basis}
3 [2] 42.03-10 {basis}
4 [6] 18-82
5 Unless a country is still within the maximum two-year grace period set forth in Article 16(4). This article states that any International Load Line Certificate which is current when the ICLL,1966 comes into force, with respect to the government of the state whose flag the ship is flying, shall remain valid for two years or until it expires, whichever is earlier.

when within jurisdictional waters of the U.S. and must obtain a Form B Load Line Certificate.

Form B load line requirements as applied to foreign vessels of countries not signatory to the Convention are normally the same as those applied to U.S. flag vessels receiving International Load Line Certificates.

Foreign (non-convention) flag vessels are not allowed to depart from U.S. waters without a Form B load line regardless of sailing schedules. This includes foreign vessels which change to non-convention flags while in U.S. ports.[6]

**Existing Vessels**[7]

The policy of the USCG regarding the treatment of existing vessels is as follows:

(a) Vessels of less than 150 g.t. built prior to 21 July, 1968 do not require a load line certificate.

(b) 1930 Convention certificates are no longer valid on U.S. flag vessels since the USCG has renounced the 1930 LLC.

(c) Vessels which were never issued a 1930 Convention Certificate will be treated as "new ships" under the 1966 Convention.

(d) Vessels which are issued 1966 Convention certificates will be treated as "existing ships" as long as they continue to meet all the standards of the 1930 Convention. If the certificates are allowed to expire regardless of the lapse time, they may be renewed upon completion of a periodic survey.

(e) Vessels which are issued a 1966 certificate as an "existing ship" are considered as a "new ship" under the terms of the 1966 Convention if major changes are made to the vessel which may affect safety. If the vessel does not meet all the standards of the 1966 Convention, the assigning authority must obtain specific authorization from the Commandant (G-MTH) before issuing a Load Line Certificate in this category.

(f) Foreign vessels which change to U.S. flag are to be considered in the same manner as addressed in items (a) through (e) above. Other reflagging requirements are specified in NVIC 10-81.

In order to take advantage of any reduction in freeboard from that previously assigned under the 1930 Convention, existing ships shall comply with all the requirements of the 1966 Convention.[8] Even where the the increase in draft is only of the order of 1 or 2 inches

[6] [8] 24 Apr 1984, MTH-5/13
[7] [8] 20 Aug 1985, MTH-5/13
[8] [1] Article 4(4)

there should be no relaxation from the condition that existing ships comply with all the requirements.[9]

## EXCEPTIONS[10]

All new and existing vessels are required to have a load line except:

(a) Ships of war;

(b) New ships less than 79 feet (24 meters) in length;

(c) Existing ships less than 150 gross tons;

(d) Pleasure yachts not engaged in trade;

(e) Fishing vessels.

| | |
|---|---|
| High Speed Craft | New ICLL Reg 2(9) provides that vessels fully certificated in accordance with the 2000 High Speed Craft Code (HSC 2000) are deemed fully compliant with the ICLL, and that the HSC certificates and permit shall have the same force and recognition as an ICLL certificate. |

[9] [4] LL.3/Circ.20, 26 May 1976
[10] [1] Article 5(1)

# GENERAL REQUIREMENTS

## GENERAL

### Assumptions[1]

The load line regulations are based on the assumption that:

a) the nature and stowage of the cargo, ballast, etc., are such as to secure sufficient stability of the ship and the avoidance of excessive structural stress;

b) also where there are international requirements relating to stability or subdivision, these requirements have been complied with.

## STRENGTH

### Assigning Authority[2]

The assigning authority is to be satisfied that the general structural strength of the vessel is sufficient for the draft corresponding to the freeboard assigned, and when requested is to furnish pertinent strength information to the Commandant.

### Classification Society[3]

Vessels built and maintained in conformity with the requirements of a classification society recognized by the Commandant are considered to possess adequate strength for the purpose of the applicable requirements in the Convention unless deemed otherwise by the Commandant.

## STABILITY

### 1930 LLC

In the 1930 LLC no specific reference was made that required stability approval. It was assumed that that those responsible for the loading and operation of the vessel would ensure that the cargo, ballast, consumables etc., are properly placed and secured to maintain sufficient stability for the vessel.

1 [1] Annex I, Chapt. 1, General
2 [2] 42.13-5
3 [2] 42.13-5

### ICLL,1966[4]

The Convention reversed the position of the 1930 Convention by including a specific stability regulation worded such that stability information must be provided to the master of every new vessel, "in an approved form to give him guidance as to the stability under varying conditions of service." This requirement has been interpreted quite firmly by the USCG to include an inclining test for almost all U.S. commercial ships, a full stability evaluation based on the inclining, and an official stability letter as a condition necessary to the issuance of the Load Line Certificate.

### Damage Stability[5]

As a load line requirement, a damage stability review is required only for vessels receiving a Type "A" or "B reduced" freeboard.[6] For details on Type "A" and "B reduced" ships see the "TYPES OF SHIPS" Section.

## INFORMATION FOR THE MASTER

### Strength[7]

Where deemed necessary[8] the master of every new vessel is to be supplied with sufficient information, in an approved form, to enable the arrangement of loading and ballasting of the ship in such a way as to avoid the creation of any unacceptable stresses in ship's structure.

### Stability[9]

The master of every new vessel which is not already provided with stability information under an international convention for the safety of life at sea in force is to be supplied with sufficient information in an approved form to give guidance as to the stability of the ship under varying conditions of service, and a copy is to be supplied to the Commandant.

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4 [10] Sec.2.5

5 [1] Reg. 27 (basis)

6 With the exception of those vessels receiving a 25% reduction in freeboard for unmanned operation which alone does not require a damage stability analysis.

7 [1] Reg. 10(1)

8 [2] 42.15-1 This requirement need not apply to any particular length, design or class of vessel where the Commandant considers it to be unnecessary and so notifies the assigning and issuing authority.

9 [1] Reg. 10(2)

## WATERTIGHT INTEGRITY

### Definition[10]

Capable of preventing the passage of water through the structure in any direction under a head of water for which the surrounding structure is designed.

### Location[11]

All openings below the freeboard deck[12] in the outer shell/envelope are to be fitted with permanent means of watertight closing.

## WEATHERTIGHT INTEGRITY

### Definition

Weathertight means that in any sea conditions water will not penetrate into the vessel.[13]

### Location

Generally all openings in the freeboard deck and in enclosed superstructures are to be provided with weathertight closing appliances.

[10] International Conference on Safety of Fishing Vessels, 1977

[11] [1] Reg. 3(9)

[12] [1] Reg. 3(9) The freeboard deck is normally the uppermost complete deck exposed to weather and sea, which has permanent means of closing all openings in the weather part thereof.

[13] [1] Reg. 3(12)

# GENERAL PARTICULARS

## FREEBOARD DECK[1]

### Definition

The freeboard deck is normally the uppermost complete deck exposed to weather and sea, which has permanent means of closing all openings in the weather part thereof, and below which all openings in the sides of the vessel are fitted with permanent means of watertight closing. It is the deck from which the freeboard is calculated.

### Discontinuous Decks

In a ship having a discontinuous freeboard deck, the lowest line of the exposed deck and the continuation of that line parallel to the upper part of the deck is taken as the freeboard deck.

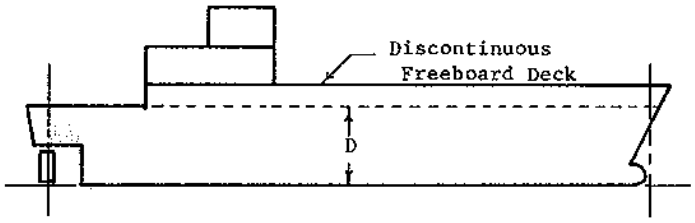



*Figure 1. Discontinuous Freeboard Deck*

Where a step in the deck to be considered as the freeboard deck, i.e. a discontinuation extending over the full breadth of the ship, is in excess of 1m (3.28 ft.) in length, the lower point of the stepped deck will govern the molded depth, and hence will become the freeboard deck location.[2]

### Lower Freeboard Decks

At the option of the owner and subject to the approval by the assigning authority a lower deck may be designated as the freeboard deck *provided* it is a complete and permanent deck continuous in the fore and aft direction at least between the machinery space and peak bulkheads and continuous athwartships. Such a freeboard deck as a minimum is to consist of suitably framed stringers at the ships sides

[1] [1] Reg. 3(9)
[2] [5] LL-48 {basis}

and transversely at each watertight bulkhead which extends to the upper deck, within cargo spaces. The width of these stringers is not to be less than can be conveniently fitted with regard to the structure and the operation of the ship. Any arrangement of stringers are to be such that structural requirements can also be met.[3]

When this lower deck is stepped the lowest line of the deck and the continuation of that line parallel to the upper part of the deck is taken as the freeboard deck.

When a lower deck is designated as the freeboard deck, that part of the hull which extends above the freeboard deck is treated as a superstructure so far as concerns the application of the conditions of assignment and the calculation of freeboard.

## MOLDED DEPTH[4]

### Definition

The molded depth (D) is the vertical distance measured from the top of the keel to the top of the freeboard deck beam at side.[5] In wood or composite ships the distance is measured from the lower edge of the keel rabbet.

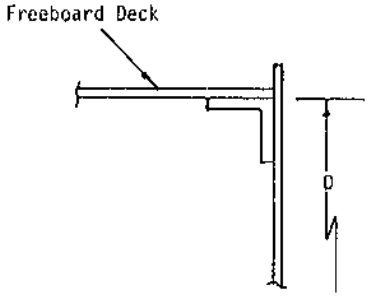



*Figure 2. Molded Depth-Angle Gunwales*

### Keel Configurations

Where the form at the lower part of the midship section is of hollow character, or where thick garboards are fitted, the molded depth is measured from the point where the line of the flat of the bottom continued inward cuts the side of the keel.[6]

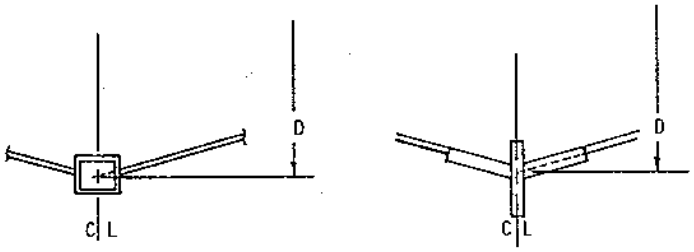
[3] [4] LL-39; LL.3/Circ.77, 13 October 1986

[4] [1] Reg. 3(5)

[5] It should be noted that the molded depth amidships, used to determine the depth for freeboard is not necessarily the same depth used to determine the length for freeboard. The least molded depth is used to find the length.

[6] The keel has been interpreted as the centerline for simplicity.

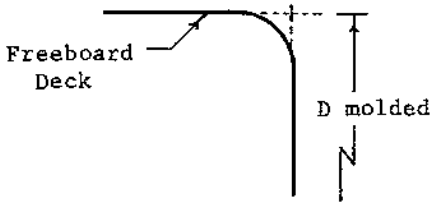
*Figure 3. Molded Depth-Keel Configurations*




**Rounded Gunwales**

In ships having rounded gunwales, the molded depth is to be measured to the point of intersection of the molded lines of the deck and side shell plating, the lines extending as though the gunwale were an angular design.

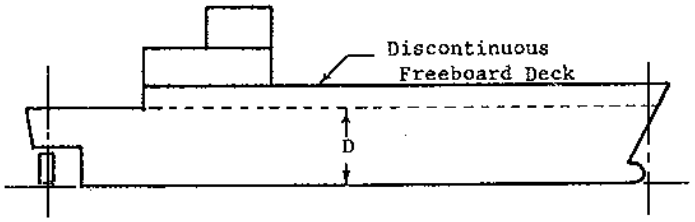
*Figure 4. Molded Depth-Rounded Gunwale*




**Discontinuous Freeboard Deck**

Where the freeboard deck is stepped and the raised part of the deck extends over the point at which the molded depth is to be determined, the molded depth is to be measured to a line of reference extending from the lower part of the deck along a line parallel with the raised part.

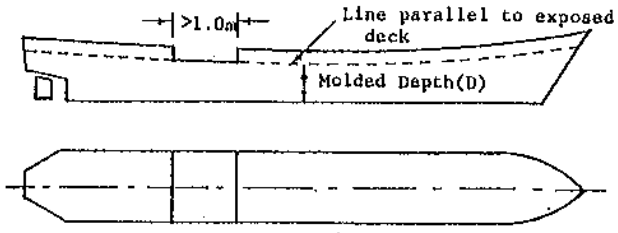
*Figure 5. Molded Depth-Discontinuous Freeboard Deck*




Where a step in the freeboard deck, i.e. a discontinuation extending over the full breadth of the ship, is in excess of 1 meter (3.28 ft) in length, the lower point of the stepped deck is to govern the molded depth.[7] Steps less than 1 meter in length or not extending the full breadth of the ship are treated as a deck recess.

[7] [5] LL-48

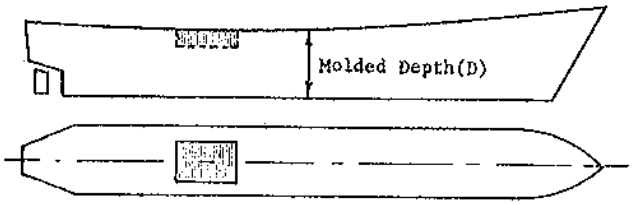
*Figure 6. Molded Depth-Stepped Freeboard Deck*




**Freeboard Deck Recess**[8]

Where a recess is arranged in the exposed freeboard deck, the freeboard calculated without regard to the recess is to be corrected for the consequent loss of buoyancy.

*Figure 7. Molded Depth-Freeboard Deck Recess*




Where the draft corresponding to the freeboard, corrected for the lost buoyancy penalty, is less than the draft corresponding to the minimum geometric freeboard determined considering the molded depth to the bottom of the recess the latter draft is to be used.

This interpretation is not intended to apply to dredgers, hopper barges or other similar types of ships with large open wells where each case is to be considered individually.

## DEPTH FOR FREEBOARD

**Definition**[9]

The depth for freeboard (Df) is the molded depth amidships, plus the thickness of the freeboard deck stringer plate, where fitted.

[8] [5] LL-48
[9] [1] Reg. 3(6)

**Rounded Gunwale**[10]

For ships with a rounded gunwale plate with a thickness different than the first inboard freeboard deck strake:

1) If the rounded gunwale maintains its thickness and extends inboard more than 8 inches (203 mm) of its center of curvature, then its thickness is to be used as the stringer plate.

2) If the rounded gunwale does not extend inboard of its center of curvature more than 8 inches (203 mm), then the first inboard freeboard deck strake is to be used as the stringer plate.

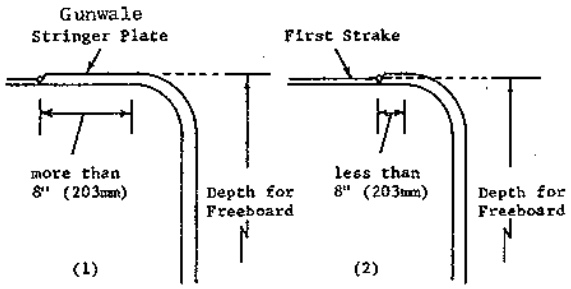



*Figure 8. Stringer Plate Thickness*

**Wooden Deck Sheathing**[11]

If the exposed freeboard deck is completely sheathed, from side to side, between superstructures, the depth for freeboard is the molded depth plus the thickness of the stringer plate, where fitted, plus:

$$\frac{T\,(L-S)}{L}$$

**T** is the mean thickness of the exposed sheathing clear of deck openings;

**S** is the total length of superstructures;

**L** is the load line length.

If the exposed freeboard deck is not completely sheathed between superstructures the correction should be:[12]

$$\frac{T(l)}{L}$$

l is the length of sheathed area which extends from side to side. Only *wood sheathing* is to be considered.

[10] [9] 17 January 1969 {basis}
[11] [1] Reg. 3(6)
[12] [4] LL.3/Circ.20, 26 May 1976

### Deck Sheathing Set-In From Ship's Side[12]

Deck sheathing on the exposed freeboard deck may be set-in up to 8 inches (203 mm) from the side of the vessel, to provide for drainage between the sheathing and the gunwale plate, and still be credited in the depth for freeboard.

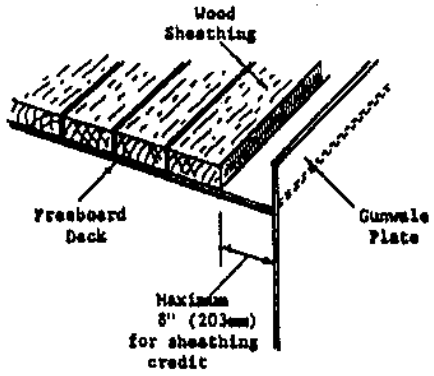



*Figure 9. Deck Sheathing*

### Topsides of Unusual Form[13]

The depth for freeboard in a ship having a rounded gunwale with a radius greater than 4% of the breadth of the ship or having topsides of unusual form is the depth for freeboard of a ship having a midship section with vertical topsides and with the same round of beam and area of topside section equal to that provided by the actual midship section.

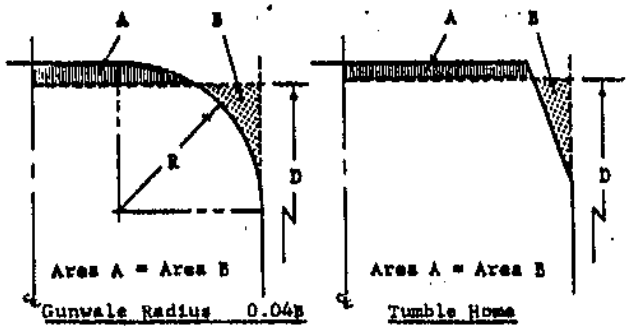



*Figure 10. Topsides of Unusual Form*

## LENGTH

### Definition[14]

The length (L) is to be taken as 96% of the total length on a waterline at 85% of the least molded depth measured from the top of the keel,

[12] [9] 12 July 1983
[13] [1] Reg. 3(6)
[14] [1] Reg. 3(1)

or as the length from the fore side of the stem[16] to the axis of the rudder stock on that waterline, if that be greater.

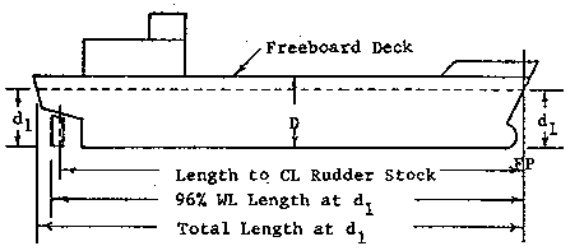



*Figure 11. Length*

SHIPS WITHOUT A RUDDER STOCK: New ICLL Reg 3(1)(b) defines the length of ships without a rudder stock as "96% of the waterline located at 85% of the least moulded depth."

**Barge (Pontoon)**

The load line length for a barge is 96% of the total length on a waterline located at 85% of the least molded depth.[17]

**Raked Keel**[18]

For ships designed with a rake of keel, the waterline on which the length is measured is to be parallel to the designed waterline.

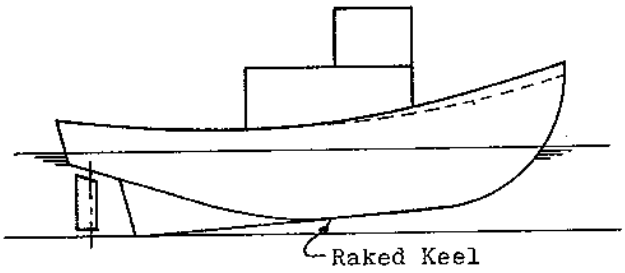



*Figure 12. Ship with Raked Keel*

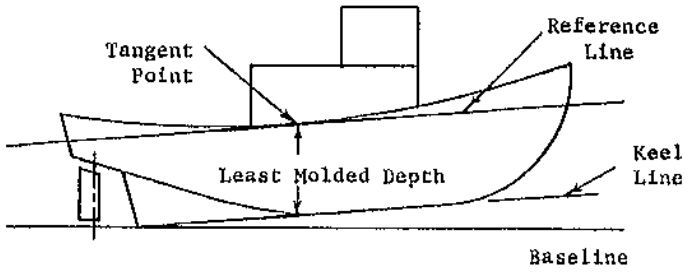
Determining (L) for a ship with a raked keel

**Step 1**

Draw a reference line parallel to the keel line of the vessel, skeg included, that is tangent to the underside of the freeboard deck. The vertical[19] distance between this reference line and the keel line at the point of tangency is to be taken as the least molded depth.

[16] Shell plating included.
[17] Provided the barge is not fitted with a workable rudder.
[18] [1] Reg. 3(1)
[19] 90 degrees to the horizontal

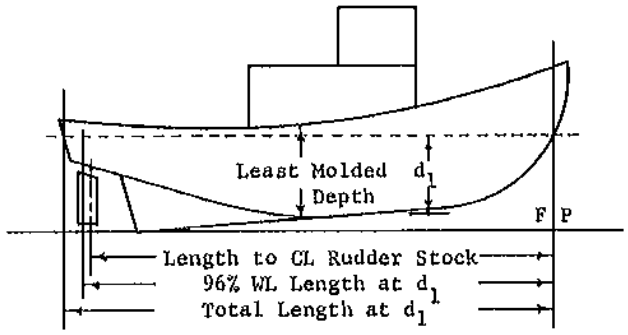
*Figure 13. Determining the Length of a ship with a Raked Keel- Step 1*




**Step 2**

Draw a horizontal waterline at 85% of the least molded depth, above the top of the keel, at the location where the least molded depth is measured. The forward perpendicular (FP) is located at the intersection of this waterline with the foreside of the stem of the vessel. The length (L) is taken as 96% of the total length of this waterline, or from the FP to the centerline of the rudder stock if that be greater.

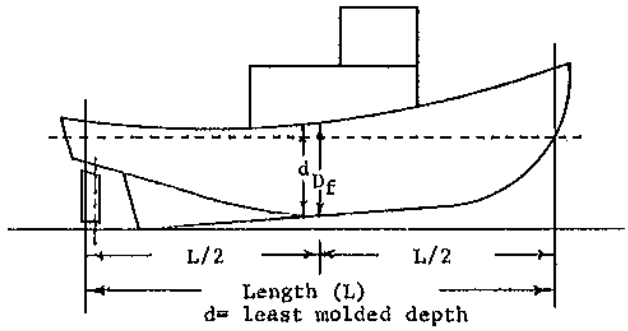
*Figure 14. Determining the Length of a Ship with a Raked Keel- Step 2*




**Step 3**

The depth for freeboard is then the molded depth plus the stringer plate thickness at the mid-point of the length (L).

*Figure 15. Determining the Depth for Freeboard of a Ship with a Raked Keel*



### Column Stabilized Units

The hull form of this type of unit makes the calculation of a geometric freeboard impracticable. The load line length to be used on the Load Line Certificate is the length overall.[20]

### Unusual Features

For barges with stern notches, jack-up units with appendages, etc. the load line length (L) is based[21] on the total overall buoyant profile length on the .85D waterline.

### Segmented Ship[22]

A vessel which is composed of a series of permanently attached sections is to have the freeboard determined by the overall length of the series. A rigidly attached, but detachable, propulsion section is to be included in the total length (L). A non-rigidly attached, detachable propulsion section should be treated as a separate vessel.

SHIPS WITH A CONCAVE STEM:
ICLL Reg 3(1)(c) defines the length of ships with a concave stem.

## BREADTH

### Definition[23]

The breadth (B) is the maximum breadth of the ship measured amidships to the molded line of the frame in a ship with a metal shell and to the outer surface of the hull in a ship with a shell of any other material.

If the maximum breadth is not amidships, such as on triangular shaped self-elevating drilling units, by definition the breadth amidships is to be used.

## BLOCK COEFFICIENT

### Definition[24]

The block coefficient[25] (Cb) is given by:

[20] Practice since 1980

[21] Either 96% of the total length of the waterline is used, or the length from the FP to the centerline of the rudder stock if that be greater.

[22] [4] LL.3/Circ.77, 13 October 1986

[23] [1] Reg. 3(4)

[24] [1] Reg. 3(7)

[25] The Cb used in the geometric freeboard calculation is not the same block coefficient used in naval architecture terminology. The length used in the calculation is the load line length (L), not the length overall. Therefore the Cb for a rectangular barge with an (L) equal to 96% of the overall length on the $d_1$ waterline is 1.042.

$$Cb = V / L(B)d_1$$

Original ICLL Reg 1(7) was revised by replacing the word "bossing" with "appendages."

V is the volume of the molded displacement of the vessel, excluding bossing, for a vessel with a metal shell. For shell of any other material, it is the volume of displacement to the outer surface of the hull. For both cases it is taken at the molded draft of $d_1$.

$d_1$ is 85% of the least molded depth.

| English Units | Metric Units |
|---|---|
| $Cb = D(35) / L(B)d_1$ | $Cb = D / L(B)d_1(1.025)$ |

where:

**D** is the molded displacement, in long tons for English units, and in metric tons for metric units;

**35** is the cubic feet per long ton in saltwater;

**1.025** is a standard density correction to be used for saltwater.[26]

**Moonpools**[27]

Where a moonpool is arranged within the hull in open communication with the sea, the volume of the moonpool below $d_1$ is not be included in the volume of displacement (V) of the vessel.

**Hog or Sag Correction**[28]

If for design consideration a vessel is built with a hog or a sag, and it is reflected in the lines drawing, structural drawings and hydrostatic properties, then the block coefficient and freeboard calculation should consider the "built-in" hog or sag.

If for operational or other reasons a vessel is built with a hog or sag which is not indicated on the above referenced drawings, then the block coefficient and freeboard calculation are not to reflect the "built-in" hog or sag. Operational hog or sag due to a particular loading arrangement is not to be considered.

MULTI-HULL CRAFT
New ICLL Reg 3(7)(b) requires that the block coefficient of a multi-hull craft be calculated using the full breadth of the vessel, not a single hull (see also page 101)

[26] A metric ton is equivalent to 1000 Kg. or 1 cubic meter in fresh water. Since the freeboard is being calculated for saltwater a density correction is needed.
[27] [4] SLF 30/17/5 {basis}
[28] [8] 2 August 1984

# TYPES OF SHIPS

## TYPE 'A' VESSEL

### Definition[1]

A Type 'A' vessel is one which is designed to carry only liquid cargoes in bulk, and has cargo tanks which have only small access openings closed by watertight gasketed covers of steel or equivalent material.

Such a vessel should *also* possess the following features:

1) high integrity of exposed deck; and

2) high degree of safety against flooding, resulting from the low permeability of loaded cargo spaces. While the U.S. retains this view, the wording has been eliminated in IMO Resolution A.320 because of the IMO decision to only investigate flooding at the summer load waterline and not at the full range of drafts. The U.S. relies on Regulation 25 of the Marine Pollution Convention for the full draft range review of tankers.

Resolution A.320 has been incorporated into revised ICLL Reg 27.

### Special Requirements[2]

Special conditions of assignment exist for Type 'A' vessels in the following areas:

1) Machinery casings

2) Crew protection

3) Hatchways

4) Freeing arrangements

For details see "Conditions of Assignment-Minimum Geometric Freeboard-Special Conditions for Type 'A' Vessels".

### Flooding Standard[3]

A damage stability review is required for all vessels receiving a Type 'A' freeboard over 150 m (492 ft) in length.

1 [1] Reg. 27(2)
2 [1] Reg. 26
3 [2] 42.20-6

Design calculations must be submitted that demonstrate that the vessel will remain afloat in a satisfactory condition of equilibrium after sustaining an assumed extent of damage using the following flooding standards:

1) If the vessel is over 150 m (492 ft) in length it must be able to withstand the flooding of any one compartment, *except* the machinery space.

2) If the vessel is over 225 m (738 ft) in length it must be able to withstand the flooding of any one compartment, treating the machinery space as a floodable compartment.

Resolution A.320 has been incorporated into revised ICLL Reg 27.

For details of assumptions to be used in the damage stability analysis see [2] Part 42 or [4] Resolution A.320.

**Equivalent Flooding Standard**[4]

A vessel that meets the requirements of:

a) International Convention for the Prevention of Pollution from Ships, 1973/1978; or

b) Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk; or

c) Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk;

is considered by the Coast Guard as meeting the flooding standard of the Load Line Convention.

## TYPE 'B' VESSEL

**Definition**[5]

All vessels which do not qualify as a Type 'A' vessel are considered to be a Type 'B' vessel.

**Flooding Standard**

There is no flooding standard associated with a Type 'B' vessel *unless* it is receiving a reduced freeboard as indicated below.

[4] [2] 42.20-3(3)
[5] [1] Reg. 27(5)

## TYPE 'B' VESSEL WITH REDUCED FREEBOARD

### General Requirements[6]

For a vessel to receive a reduced freeboard based on a damage stability analysis it must be over 100 m (328 ft) in length.

Special consideration is to be given to the same areas as items 2,3 and 4 of the special requirements for Type 'A' vessels previously addressed. For details see "Conditions of Assignment Minimum Freeboard-Special Considerations" in Chapter III of this manual.

### 'B-60' Flooding Standard[7]

The freeboards for a Type 'B' vessel which comply with the above items may be reduced up to 60% of the total difference between the tabular freeboard for a Type 'A' and a Type 'B' vessel, *provided* that the vessel complies with the following flooding standard:

Design calculations must be submitted that demonstrate that the vessel will remain afloat in a satisfactory condition of equilibrium after sustaining an assumed extent of damage using the following flooding standards:

1) If the vessel is 225 m (738 ft) or less in length it must be able to withstand the flooding of any one compartment, *except* the machinery space.

2) If the vessel is over 225 m (738 ft) in length it must be able to withstand the flooding of any one compartment, treating the machinery space as a floodable compartment.

Resolution A.320 has been incorporated into revised ICLL Reg 27.

For details of assumptions to be used in the damage stability analysis see [2] Part 42 or [4] Resolution A.320.

### 'B-100' Special Requirements[8]

A vessel assigned a Type 'B-100' freeboard is to comply with items 1, 2 and 4 of the special requirements previously addressed for a Type 'A' vessel.

### 'B-100' Flooding Standard[9]

The freeboards for a Type 'B' vessel which comply with the above items may be reduced up to the total difference between the tabular

6 [1] Reg. 27(7)
7 [2] 42.20-7
8 [1] Reg. 27(9)
9 [2] 42.20-8

Reg 27(7) is now revised Reg 27(8) & Reg 27(9) is now revised Reg 27(10)

freeboard for a Type 'A' and a Type 'B' vessel[10], *provided* that the vessel complies with the following flooding standard:

Design calculations must be submitted that demonstrate that the vessel will remain afloat in a satisfactory condition of equilibrium after sustaining an assumed extent of damage using the following flooding standards:

1) If the vessel is 225 m (738 ft) or less in length it must be able to withstand the flooding of any two adjacent fore and aft compartments, *except* the machinery space.

2) If the vessel is over 225 m (738 ft) in length it must be able to withstand the flooding of any two adjacent fore and aft compartments, treating the machinery space, taken alone as a floodable compartment.

Resolution A.320 has been incorporated into revised ICLL Reg 27.

For details of assumptions to be used in the damage stability analysis see [2] Part 42 or [4] Resolution A.320.

## BARGES- 25% REDUCTION IN FREEBOARD

### Special Requirements[11]

A barge or ship without independent means of propulsion may be given a 25% reduction in freeboard *provided* it complies with all of the following:

1) It is unmanned[12];

2) Contains only small access openings on the freeboard deck closed by watertight covers of steel or equivalent material.

### Access Openings[13]

The term "small" access openings means that any single opening is not to have an area greater than 1.5 $m^2$ (16 $ft^2$). If the combined area of two or more access openings on the freeboard deck exceeds 1.5 $m^2$, a 25% reduction in freeboard may still be granted *provided* the area of each opening does not exceed 1.5 $m^2$.

A 25% reduction in freeboard may be granted if the area of an access opening on the freeboard deck exceeds 1.5 $m^2$ *provided*:

[10] For a 'B-100' freeboard the tabular freeboard for a Type 'A' vessel is used, however the assigned freeboard is generally larger than a Type 'A' since the other corrections to the tabular freeboard consider the vessel to be a Type 'B' vessel.

[11] [1] Reg. 27(11) Reg 27(11) is now revised Reg 27(14)

[12] [2] 42.20-10(h). Unmanned vessels are not required to comply with the requirements of Regs. 25, 26(2) and (3), and 39.

[13] [4] LL.3/Circ.42, 13 Apr 82

1) the opening is fitted with a plate secured by closely spaced bolts; and

2) their joining parts are properly gasketed; and

3) the arrangement, for all practical purposes, has an equivalent structural integrity and tightness as an intact deck.

The access opening referred to above is considered on the exposed freeboard deck. If there is an opening in the freeboard deck of an unmanned barge greater than 1.5 $m^2$ (16 $ft^2$) which does not comply with the three provisions given above, a 25% reduction in freeboard *may* be given only *upon* compliance with all of the following[14]:

a) The opening is protected by a deck house or superstructure of substantial construction which complies with the structural requirements for such a structure;

b) Doors and wall vents in the deck house or superstructure exterior boundary comply with Regulations 12 and 19 respectively. The size of any such opening is not to exceed 1.5 $m^2$ (16 $ft^2$);

c) Windows or side scuttles in the exterior boundary of the deck house or superstructure are not greater than 1.5 $m^2$, and are provided with attached deadlights;

d) Hatch openings located in the deck house top or superstructure deck are less than 1.5 $m^2$, and are provided with proper weathertight covers, or such openings comply with the three requirements given above for bolted plates.

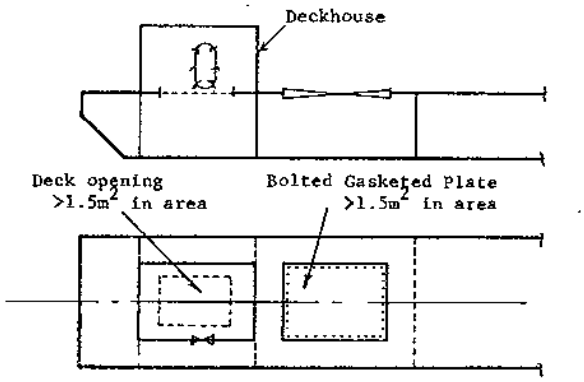



*Figure 16. Barge Access Openings- 25% Reduction in Freeboard*

## BARGES-DECK CARGO[15]

The barge shown in the preceding figure qualifies for a 25% reduction in freeboard *provided* it was unmanned and complied with the requirements indicated above in items 1-3, or alternatively items a-d.

[14] Practice since Nov 1981
[15] [4] LL.3/Circ.42, 18 Apr 82

A Type 'A' freeboard can only be assigned to liquid cargo barges. If deck cargo is to be carried on the barge only a Type 'B' freeboard may be assigned, even if the barge possesses the same integrity of exposed deck and equivalent safety against flooding as a normal tank barge.

### Tank Barges[16]

Deck cargo may be carried on a tank barge, assigned a Type 'B' freeboard, *provided* the deck structure is adequate and the deck cargo and methods of loading or unloading do not create an undue hazard. As a matter of policy the USCG considers containerized cargo as a potential ignition source since effective control of the container contents is not generally feasible.

## INCREASED FREEBOARDS

### Definition

An increased freeboard[17] is one which is greater than the minimum Type 'A' or Type 'B' freeboard, for each respective type of vessel, calculated using the vessels geometric particulars in accordance with the Convention.

Freeboards may be required to be increased due to such considerations such as strength, stability, deficient hatch covers, location of shell doors or side scuttles, operational considerations or other reasons.

### Deficient Hatch Covers[18]

Type 'B' vessels with hatch covers in position 1 which are:

1) Made of wood; or

2) Steel not complying with the indicated strength criteria; or

3) Other material that does not comply with the steel criteria;

are to have their tabular freeboard increased in accordance with the table given in Reg. 27(10). Reg 27(10) is now revised Reg 27(6)

### Conditions of Assignment[19]

The conditions of assignment stated in Regulations 10 - 26 apply to every vessel to which a minimum freeboard is assigned. Relaxations

[16] [8] 18 February 1983, G-MTH-4

[17] An assigned freeboard is not considered to be an "increased freeboard" if the only penalty imposed is due to a deficient bow height, per Reg. 40(1).

[18] [1] Reg. 27(11) Reg 27(11) is now revised Reg 27(14)

[19] [1] Reg. 2(5)

from these requirements may be granted to a vessel to which a greater than minimum freeboard is assigned *provided* the safety conditions of the vessel are deemed satisfactory to both the assigning authority and the Commandant.[20]

[20] [2] 42.13-10