International Load Lines Convention, 1966/2005

Prof. Manuel Ventura

MSc in Naval Architecture and Marine Engineering

Historical Background

Lloyds Rules
- The first recommendations about cargo loading limits based on the freeboard were introduced by Lloyds Register in 1835, but were only applied to the ships registered
- The FB was assigned as a function of the height of the cargo hold (3 inch/ft)

Plimsoll Line
- A member of the British Parliament and coal merchant, Samuel Plimsoll advocated the creation of legislation about load lines
- The *Merchant Shipping Act* of 1876 made the load lines mandatory
- In 1894 it was adopted the positioning on the hull of marks composed by a circle cut in half by an horizontal line, later designated by Plimsoll marks

International Load Lines Convention
- The first International Convention was adopted in 1930

International Load Lines Convention, 1966/2005

Convention

- It was adopted in 1966, Protocol of 1988 and amendments in 2003

Determines

- Freeboard
- Minimum bow height
- Heights of the hatchway coamings, dimensioning of the hatch covers and their means of watertight closing
- Minimum heights for ventilators and air pipes
- Measures for protection of the crew – hand-rails and bulwarks
- Standard damage for checking the flooding conditions
- Minimum stability conditions acceptable after flooding

International Load Lines Convention, 1966/2005

Application

- Ships engaged on international voyages

Exceptions

- New ships, with length < 24 m
- Existing ships, with GT < 150
- Pleasure craft not engaged in trade
- Fishing vessels
- War ships

National Legislation

- In Portugal, this Convention was approved and transcript to the national legislation by the Decreto-Lei No.49209/69
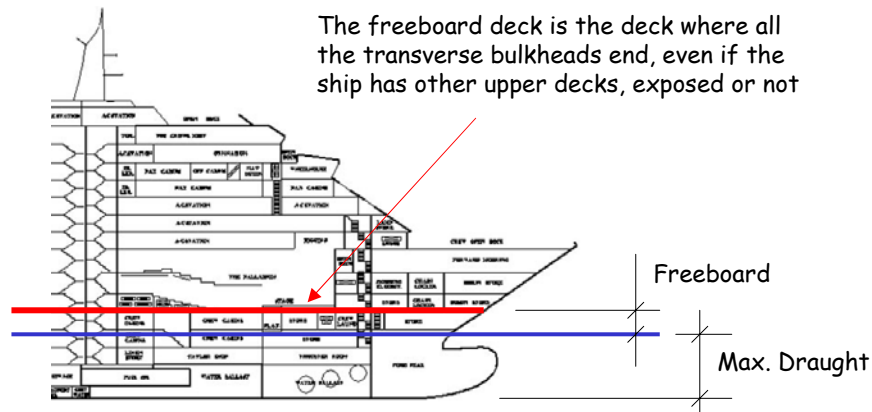
Definitions (1)

- **Length** is equal to the greater of:
  - 96% of the total length measured on a waterline at 85% of the least molded depth, measured from the top of the keel (L1), or
  - The length measured from the fore side of the stem to the axis of the rudder stock, on that waterline (L2).

$$L = MAX\left(0.96 \cdot L_1, L_2\right)$$
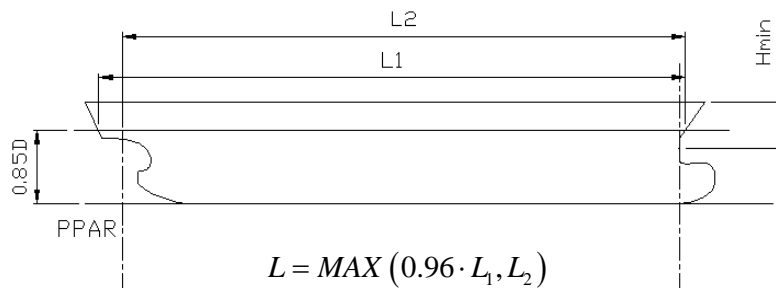
Definitions (2)

- **Freeboard**
  it is the vertical distance measured amidships, from the upper edge of the deck line, to the upper edge of the related load line.

- **Freeboard Deck**
  it is the uppermost complete deck exposed to weather and sea, which as permanent means of closing all openings in the weather part thereof, and below which all openings in the sides of the ship are fitted with permanent means of watertight closing.

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Freeboard Deck

The freeboard deck is the deck where all the transverse bulkheads end, even if the ship has other upper decks, exposed or not

Freeboard

Max. Draught

The freeboard deck is the one from which the freeboard is measured, defining the max. summer draught


Definitions (3)

- **Minimum Bow Height**

  it is the vertical distance measured on the forward perpendicular, from the load line corresponding to the Summer freeboard, up to the upper part of the intersection of the exposed deck with the side shell.

- **Superstructure**

  it is a decked structure on the freeboard deck, extending from side to side of the ship or with the side plating not being inboard of the shell plating more than 4% of the ship breadth (B).

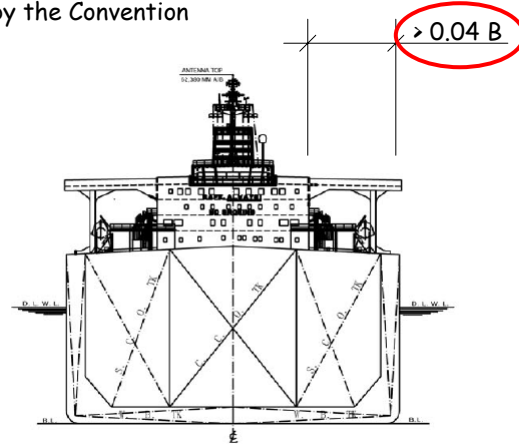NOTE: to be considered as a superstructure by the ILLC a deck structure must have b ≥ 0.92B

Superstructures according to LLC
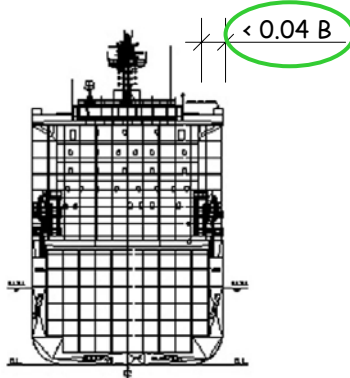
NOT considered a superstructure
by the Convention

Considered a
superstructure

< 0.04 B

> 0.04 B

Ships Type "A"

Ships that comply to the following requirements:

- Were designed to carry only **liquid cargoes in bulk**
- The cargo tanks have **only small access openings** which must be closed by watertight doors, of steel or equivalent material, provided with gaskets.
- They have **low permeability** in the loaded cargo compartments
- When loaded to the Summer load line, must float in satisfactory *conditions* after the flooding due to the standard damage
- If the ship has L > 150 m the flooded compartment(s) must have an assumed permeability of 0.95.
- If the ship has L > 225 m the **engine room** should be also considered as **a floodable compartment**, with an assumed permeability of 0.85.

Ships Type "B"

All the ships which are not of type "A".

Ships Type "B60" and "B100"

- Ships of type "B", with L > 100 m, may be assigned lower freeboards values if they satisfy the following conditions:
  - A ship that when loaded to the Summer load line will float in a satisfactory condition, after **flooding any compartment other than the engine room**.
  - If L > 200 m, the engine room must also be considered a floodable compartment.
  - A ship that satisfy these conditions may have its tabular freeboard reduced by 60% of the difference between the values indicated for the type "A" and for the type "B".
- The reduction can be increased up to 100% satisfying the additional requirements:
  - To support the simultaneous flooding of **2 adjacent compartments**, by damage of the transverse bulkhead (not considering the engine room floodable)

Standard Damage

Vertical extent: from the base line, without upper limits

Transversal extent: MIN(B/5, 11.5 m)

Longitudinal extent: A single compartment, if the longitudinal internal boundary of the compartment is not inside the transversal extent

Satisfactory Equilibrium Conditions after Flooding (1)

- The final waterline after flooding must be under the edge of any opening capable of leading to a progressive flooding
- The heeling angle must be less < 15°. If no part of the deck is submerged, it is acceptable an angle ≤ 17°.
- The metacentric height must be positive (GM > 0).

Satisfactory Equilibrium Conditions after Flooding (2)

- If any part of the deck above the compartment considered flooded is submerged, the residual stability should be investigated and verified the following:
  - There is a possible heeling of 20° beyond the position of equilibrium
  - It has a maximum value of the stability arm ≥ 0.1 m
  - The dynamic stability up to that value must be ≥ 0.0175 m.rad.

Assignment of the Freeboard (1)

1. **Base freeboard [mm]**
- For lengths L < 365 m, the base freeboard will be obtained by linear interpolation in <u>tables</u>

$$bl = f_1(L) \qquad\qquad (Type\ \ A)$$
$$= f_2(L) \qquad\qquad (Type\ \ B)$$

- For lengths 365 m < L < 400 m

$$bl = +221 + 16.10 \cdot L - 0.02 \cdot L^2 \qquad (Type\ \ A)$$
$$= -587 + 23 \cdot L - 0.0188 \cdot L^2 \qquad (Type\ \ B)$$

- For lengths L > 400 m, the freeboard will be constant:

$$bl = 3460 \qquad\qquad (Type\ \ A)$$
$$= 5605 \qquad\qquad (Type\ \ B)$$

Assignment of the Freeboard (2)

Table A
Freeboard table for type «A» ships

Length of ship — Metres	Freeboard — Millimetres	Length of ship — Metres	Freeboard — Millimetres	Length of ship — Metres	Freeboard — Millimetres
24	200	41	344	58	544
25	208	42	354	59	559
26	217	43	364	60	573
27	225	44	374	61	587
28	233	45	385	62	600
29	242	46	396	63	613
30	250	47	408	64	626

Tables for the determination of the base freeboard value

Table B
Freeboard table for type «B» ships

Length of ship — Metres	Freeboard — Millimetres	Length of ship — Metres	Freeboard — Millimetres	Length of ship — Metres	Freeboard — Millimetres
24	200	94	1 154	164	2 600
25	208	95	1 172	165	2 620
26	217	96	1 190	166	2 640
27	225	97	1 209	167	2 660
28	233	98	1 229	168	2 680
29	242	99	1 250	169	2 698
30	250	100	1 271	170	2 716

The values of the freeboard for intermediate lengths will be obtained by linear interpolation.

Assignment of the Freeboard (3)

2. Corrections [mm]

- Length < 100 m

$$\Delta bl_1 = 7.5 \cdot (100 - L) \cdot \left(0.32 - \frac{E}{L} \right)$$

- Cb > 0.68

$$\Delta bl_2 = (bl + \Delta bl_1) \cdot \frac{C_b + 0.68}{1.36} - bl$$

- Depth > L/15

$$\Delta bl_3 = \left(D - \frac{L}{15} \right) \cdot R$$

$em\ que:$

$$R = \frac{L}{48} \quad if \quad L < 120m$$

$$R = 250 \quad if \quad L \geq 120m$$

Assignment of the Freeboard (4)

2. **Corrections (cont)**
- Position of the deck line
- Recess in freeboard deck
- Deductions for superstructures and deckhouses (it may be negative)
- Shear different from the line of standard shear

Standard Sheer

	Station	Ordinate [mm]	Factor
Aft Half	Aft PP	25.0*(L/3 + 10)	1
	1/6 L from AP	11.1*(L/3 + 10)	3
	1/3 L from AP	2.8*(L/3 + 10)	3
	Amidships	0	1
Fwd. Half	Amidships	0	1
	1/3 L from FP	5.6*(L/3 + 10)	3
	1/6 L from FP	22.2*(L/3 + 10)	3
	Fwd PP	50.0*(L/3 + 10)	1

Determination of the values of the standard sheer to determine the correction due to sheer

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Minimum Bow Height

- Is a function of the Length (L), the block coefficient (Cb), the waterline area coefficient forward (Cwl) and draught (d1)

$$H = \left[6075 \cdot \left(\frac{L}{100} \right) - 1875 \cdot \left(\frac{L}{100} \right)^2 + 200 \cdot \left(\frac{L}{100} \right)^3 \right] \times$$

$$\left[2.08 + 0.609 \cdot Cb - 1.603 \cdot Cwl - 0.0129 \cdot \left(\frac{L}{d1} \right) \right]$$

d1 = 0.85D
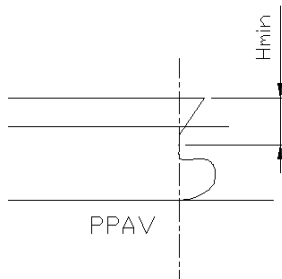
- Where the bow height required is obtained by sheer, the sheer shall extend for at least 15% L measured from the forward perpendicular.
- Where it is obtained by fitting a superstructure, such superstructure shall extend from the stem to a point at least 0.07 L abaft the FWD PP, and shall be enclosed.
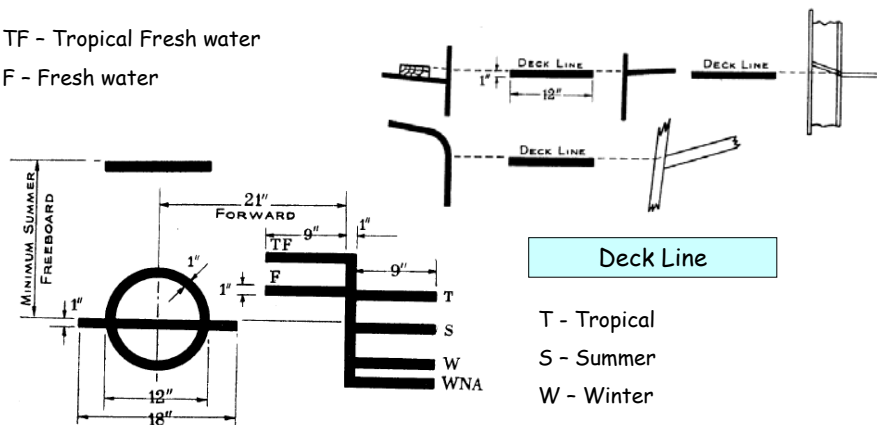

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Freeboard Marks (1)

TF – Tropical Fresh water

F – Fresh water

Deck Line

T - Tropical

S – Summer

W – Winter

WNA – Winter North Atlantic

Plimsoll Marks

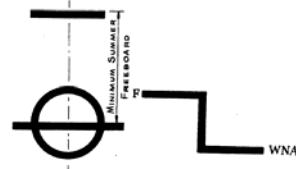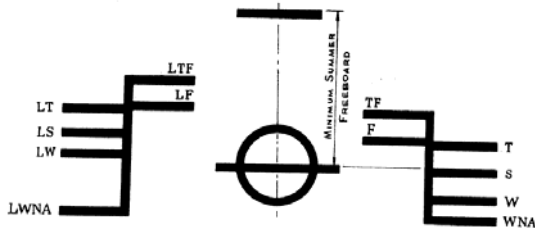M.Ventura   Load Lines Convention   22

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Freeboard Marks (2)

LT – Tropical
LS - Summer
LW – Winter
LWNA – Winter North Atlantic
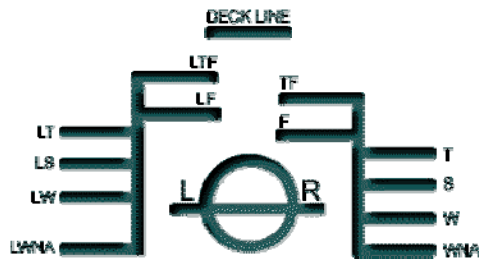
LTF – Tropical Fresh water
LF – Fresh water

Marks for sailing ships

Additional marks (L) in ships carrying lumber on deck

Freeboard Marks (3)

Generally the initials of the classification society that approved the freeboard assignment and issues the related Certificates are added to the freeboard marks (in this example LR = Lloyds Register).

Doors in Bulkheads of Superstructures

- All access openings in bulkheads at **ends of enclosed superstructures** shall be fitted with doors of steel or equivalent material, stiffened and fitted so that the whole structure is of equivalent strength to the un-pierced bulkhead and weathertight when closed.

- The means for securing these doors weathertight shall consist of gaskets and clamping devices, and the doors shall be so arranged that they can be operated from both sides

- Doors shall **open outwards** to provide safety against the impact of the sea.

- The **height of the sills** of access openings in bulkheads at ends of enclosed superstructures shall be at least 380 mm above the deck.
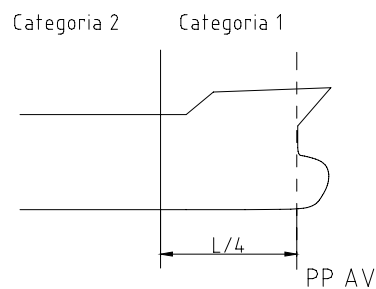
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Deck Zones

- The LLC establishes also some dimensions of equipment that affects the safety of the ship and of the crew.

- For the purpose of classifying the openings according to their location, two zones are specified on the freeboard deck:
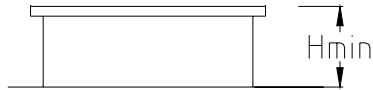

Categoria 2   Categoria 1

L/4

PP AV

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Hatch Coamings

The minimum height of the hatch coamings, as a function of the deck zone is:
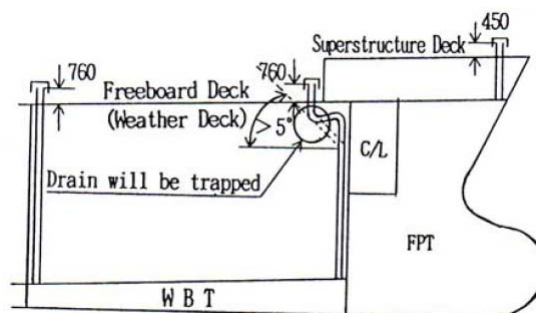

Hmin = 600 mm (Category 1)
Hmin = 450 mm (Category 2)

Air Pipes (1)
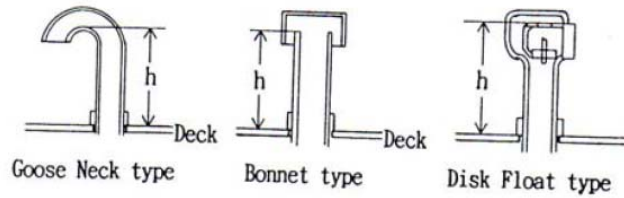
The minimum height of air pipes, as a function of the deck is:

Hmin = 760 mm (on the freeboard deck)
Hmin = 450 mm (on the superstructures deck)

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Air Pipes (2)

Height measurement for different types of air pipes

Side Scuttles, Windows and Skylights

- **Side scuttles** are defined as:
    - Having round or oval openings
    - Area ≤ 0.16 m2 (Diameter < 0.45 m)

- **Windows** are defined as being:
    - Rectangular openings generally, having a radius at each corner relative to the window size and round or
    - Oval openings with an area > 0.16 m2.

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Side Scuttles

- Side scuttles to the following spaces shall be **fitted with hinged inside deadlights**:

  (a) spaces below freeboard deck;

  (b) spaces within the first tier of enclosed superstructures

  (c) first tier deckhouses on the freeboard deck protecting openings leading below or considered buoyant in stability calculations.

- Deadlights shall be watertight if fitted below the freeboard deck and weathertight if fitted above.

- Side scuttles **shall not be fitted** in such a position that their sills are below a line drawn parallel to the freeboard deck at side and having its lowest point 2.5% of the breadth (B), or 500 mm, whichever is the greatest distance, above the Summer Load Line (or Timber Summer Load Line if assigned).

Windows

- Windows shall **not be fitted** in the following locations:

  (a) below the freeboard deck

  (b) in the first tier end bulkheads or sides of enclosed superstructures

  (c) in first tier deckhouses that are considered buoyant in the stability calculations.

- Side scuttles and windows at the side shell in the **second tier** shall be weathertight if the superstructure protects direct access to an opening leading below or is considered buoyant in the stability calculations.

Handrail and Bulwarks

- Guard rails or bulwarks shall be fitted around all exposed decks

- The height of the bulwarks or guard rails shall be at least 1.0 m from the deck

- The interval between stanchions to be about 1.50 m

Hmin = 1.00 m

MAX 380 mm

MAX 230 mm

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