

1. Breakwater
2. Hatch cover crane
3. Forward hold bulkhead
4. Tank top (top of double bottom)
5. Longitudinal bulkhead between hold and side tanks
6. Container supports
7. Hatch coaming top rail
8. Cargo, engine parts (diesel generators)
9. Hatch covers (pontoon)
10. Adjustable transverse bulkhead

The above ship is being loaded with machinery and copper bars. In this case the ship is similar to that for which the hydrostatic particulars are given in the leaflet.

1.14 Plimsoll mark and deck line

The Plimsoll line or freeboard mark is a symbol indicating the minimum freeboard and therewith the maximum immersion of the ship, leaving a minimum freeboard for safety.

The **mark** consists of a circle with a diameter of 300 mm, through which a horizontal line is drawn with its upper edge passing through the centre of the circle.

This level indicates the minimum freeboard in salt water under summer conditions.

Beside this circle, the loadline mark consists of a number of horizontal lines indicating the minimum freeboard required for other than summer conditions.

All freeboard lines are 25 mm wide and are connected by a vertical line.

The abbreviations used in the marked load lines must be in the language of the vessel's flag state.

If the crew is of mixed nationality, the language used is generally English.

This enables the crew to ensure the ship is not overloaded.

The ship may load cargo until the water level reaches the upper edge of the relevant load line.

The Plimsoll mark is placed at half length on each side of the ship.

The freeboard lines are based on of the freeboard calculation, where the summer freeboard in salt water is established.

The main parametres of the calculation are length, width (beam), sheer, length of superstructure, length/depth ratio, etc.

The minimum operating freeboard depends on:

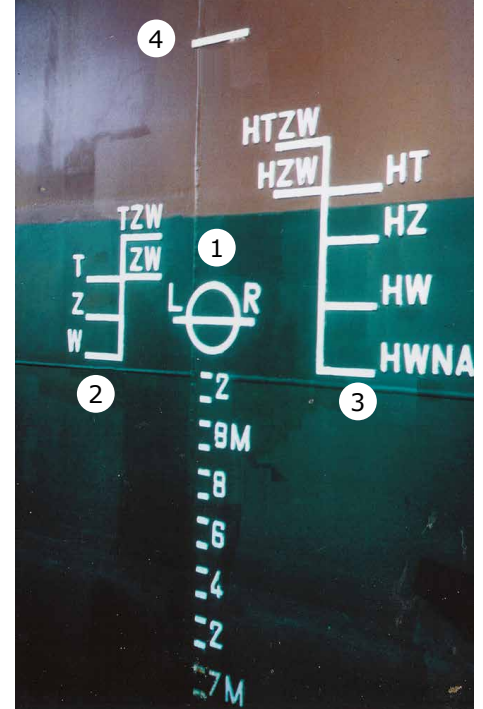
- ships position at sea
- the time of year (summer, winter).

The **deck line** is the extended line from the upper side of the freeboard deck at the ships side. The deck line is placed above the Plimsoll mark so that the freeboard can be easily monitored by the ships crew or other interested parties.

Normally the deck line is at the level of the weather deck, but if the weather deck does not correspond with the freeboard deck (e.g. Ro-Ro, passenger ships), then it is placed at the level of that deck.

When the distance between the deck line and the mark is impractically large, or the deck/shell plate connection is rounded (tankers, bulk carriers), a reference line is positioned at a lower level.

- T: Tropical
- S: Summer
- W: Winter
- WNA: Winter North Atlantic
- F: Fresh



Plimsoll mark (1) with normal allowances (2) and with special timber allowances (3). The deck line (4) is marked off above the Plimsoll circle.

GL: Germanischer Lloyd
LR: Lloyd's Register

1.14.1 Load lines

The above-mentioned load lines apply to an upright ship. There are different load-lines for different loading conditions, such as:

- **Light load line**
The load line of a ship carrying only her regular inventory.
- **Fully loaded load line**
The load line of maximum load draft in seawater.
- **Construction (Scantling) water line (CWL)**
The load line is used as the criterion to which the various structural components are designed.

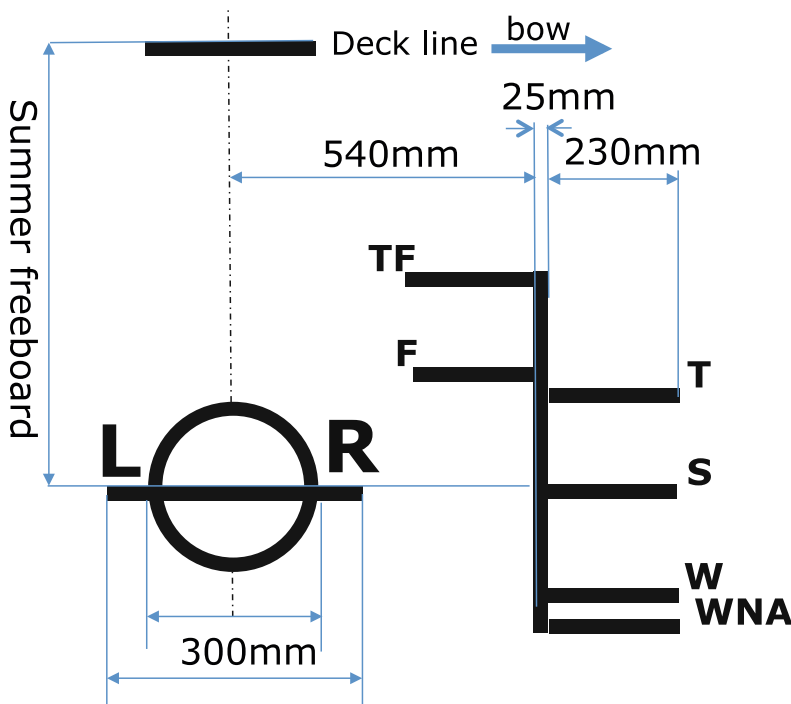
1.14.2 Ships carrying timber deck cargo

When a ship is carrying a deck cargo of timber and certain requirements are met, this ship is allowed to have more draft (less freeboard). This is due to the additional reserve buoyancy caused by the cargo.

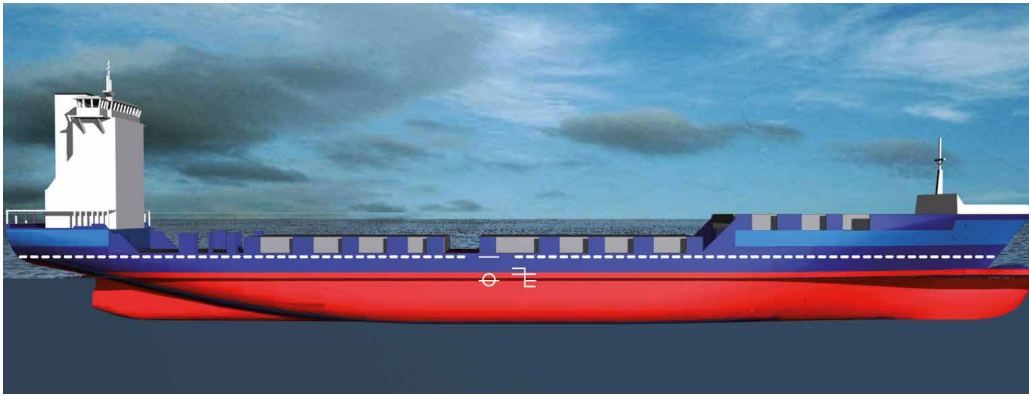
To indicate this, the ship has a special freeboard mark for carrying a deck cargo of timber, the so-called timber mark.

1.14.3 Dredgers

Dredgers are allowed to sail with a reduced freeboard, provided they can drop their cargo instantly, so creating a higher freeboard.



The draft marks and Plimsoll mark have to be marked permanently on the shell plating and are usually welded



1.14.4 International Convention on Load Lines

It has been long recognized that the minimum height of the freeboard, and the limitations on the draft to which a ship may be loaded, make a significant contribution to the seaworthiness of ships.

It is important for:

- the strength of a vessel
- the range of the stability
- the vessels ability to withstand impact of waves and ingress of water through deck openings
- the degree to which the vessel can survive damage.

In 1930 an International Shipping Conference established the minimum freeboard. This Conference was revised and adopted in 1966 by the predecessor of IMO and became known as the "International Convention on Load Lines". This Convention was last revised in 2003.

Basically, this Convention considers two types of vessels.

- **A-ships**, being tankers, which, because their decks have a high degree of watertight integrity, are permitted to have a relatively low freeboard.
- **B-ships**, vessels which are not tankers, which, because they possess large hatches and other deck openings which are not permanently closed, require a larger freeboard.

In the B-ships category, there are exceptions for vessels such as ore carriers, which have relatively small holds and deck openings.

Many factors must be taken into account in establishing the minimum freeboard.

For instance, but not restricted to, the:

- the length of the vessel;
- the size of the scantlings;
- the height of the bow;
- the length of the elevated forecastle if it applies;
- the size of the hatch openings and the type of hatches used to cover them.

On the basis of these factors, an exact calculation of the minimum summer freeboard and the position of the plimsoll mark can be made.

1.15 Relationship between the observed draft and displacement

Draft has a direct correlation to the displacement of the ship. Therefore, it is important that the draft is accurately read since each incorrect centimetre reading can mean a displacement difference of several tons. Below are the data of a large tanker about 320 metres in length and about 54 metres wide.

1.15.1 Tons/cm

As shown in the table, the displacement can be determined as well as the number of tons per cm. This figure indicates the number of tons that must be loaded or discharged in order to obtain a difference of 1 cm draft

Example: Note the displacement in sea water with a draft of 18.40 metres. Add on the number of tons per cm (318).

The sum of these figures must be the same as the displacement in sea water with a draft of 18.40 m + 1 cm = 18.41 metres.

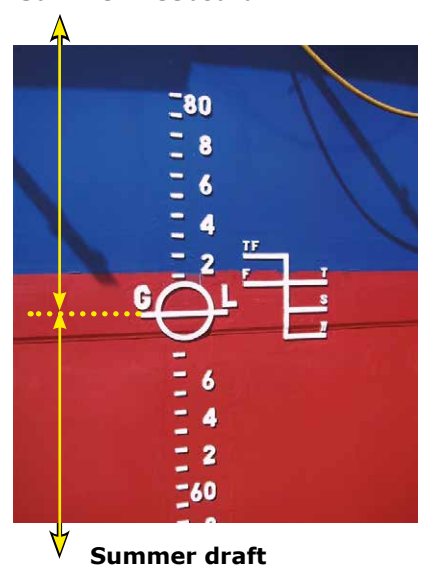
The number of tons per cm can be calculated if the surface area of the waterline is known, that is: ... m² × 0.01 m. × 1.025 t/m³ = ... tons

Fragment of the hydrostatic table

Trim: 0,00m

Draft	Displ.	Displ.	LCB	VCB	LCF	KMt	MCT	T/cm
m	Fw, t	SW, t	m	m	m	m	tm/cm	t/cm
3,80	3429	3514	42,77	2,05	40,87	7,34	55,92	10,92
3,81	3439	3525	42,76	2,05	40,86	7,34	56,01	10,93
3,82	3450	3536	42,76	2,06	40,84	7,33	56,11	10,94
3,83	3461	3547	42,75	2,06	40,82	7,32	56,21	10,95
3,84	3471	3558	42,75	2,07	40,80	7,32	56,31	10,95
3,85	3482	3569	42,74	2,07	40,79	7,31	56,41	10,96
3,86	3493	3580	42,73	2,08	40,82	7,31	56,26	10,96
3,87	3503	3591	42,73	2,08	40,80	7,30	56,36	10,96
3,88	3514	3602	42,72	2,09	40,78	7,29	56,46	10,97
3,89	3525	3613	42,72	2,10	40,76	7,29	56,56	10,98

Summer freeboard

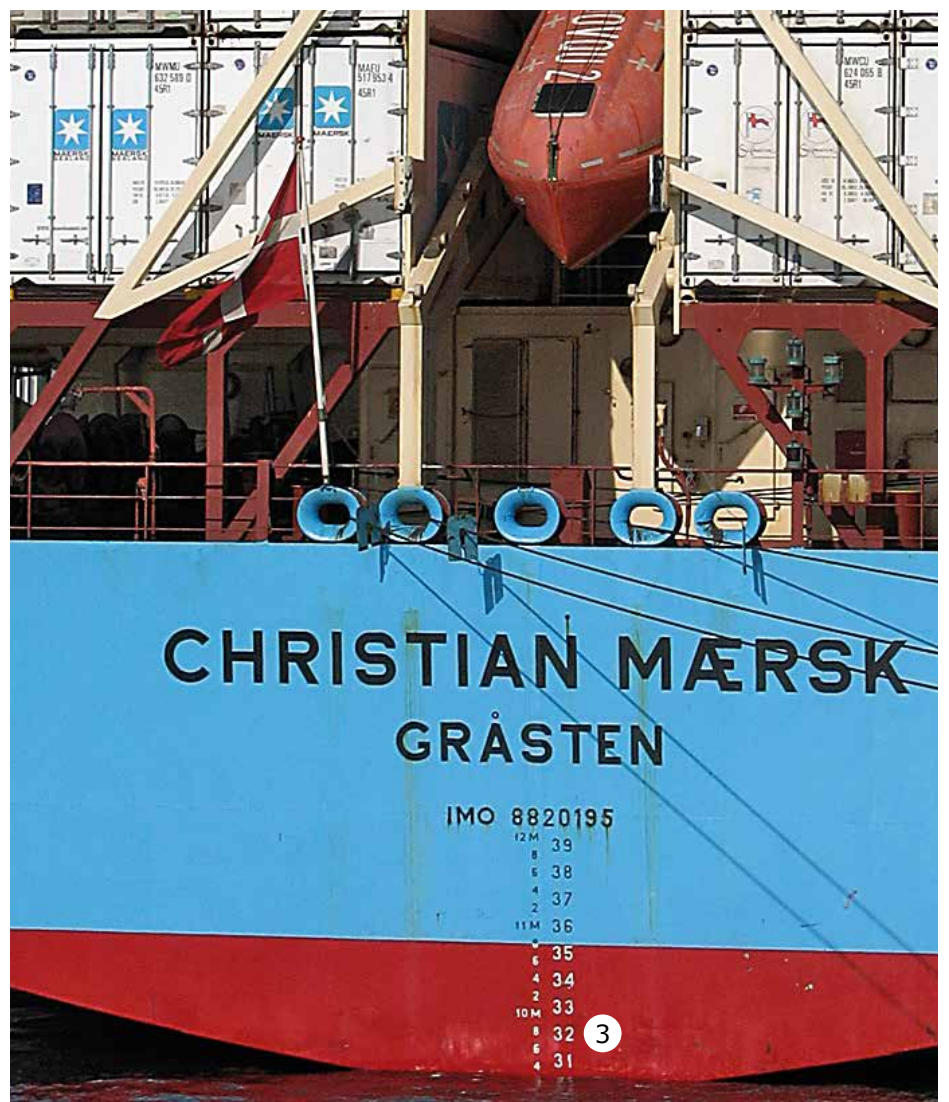
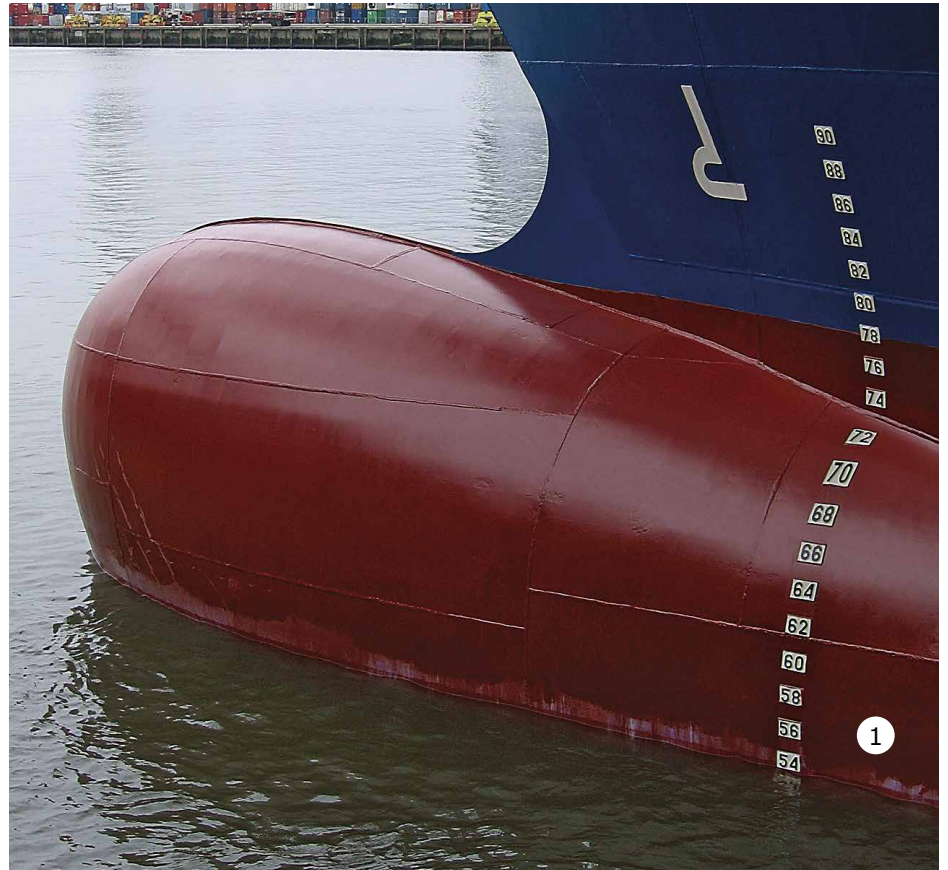


1.16 Permanent marks on the ships shell plating

It is very important that draft marks can be read as accurately and easily as possible. However, some experience is required to do this, as the visibility of the marks and movement of water often make an accurate reading difficult. Several examples with explanations are provided on these pages:

1. Draft to portside fore: 53.8 dm
2. Draft to portside fore: 5.17 metres
3. Draft on the stern is given in metres and feet: 9.36 m. = 30'7"
4. Draft to starboard aft: 9.35 metre.
5. Draft midships
6. Deck line
7. Plimsoll mark
8. The water level does not reach the draft marks below the stern under the transom. These marks must be read on the stern to port or starboard. This will actually not be easy due to the stern's shape.
9. The draft is visible on the aft perpendicular to port. From above to the rudder stock. In practice, difficult to read.

The draft marks are not always shown on the perpendiculars. In this situation, the readings need to be corrected. See chapter 3



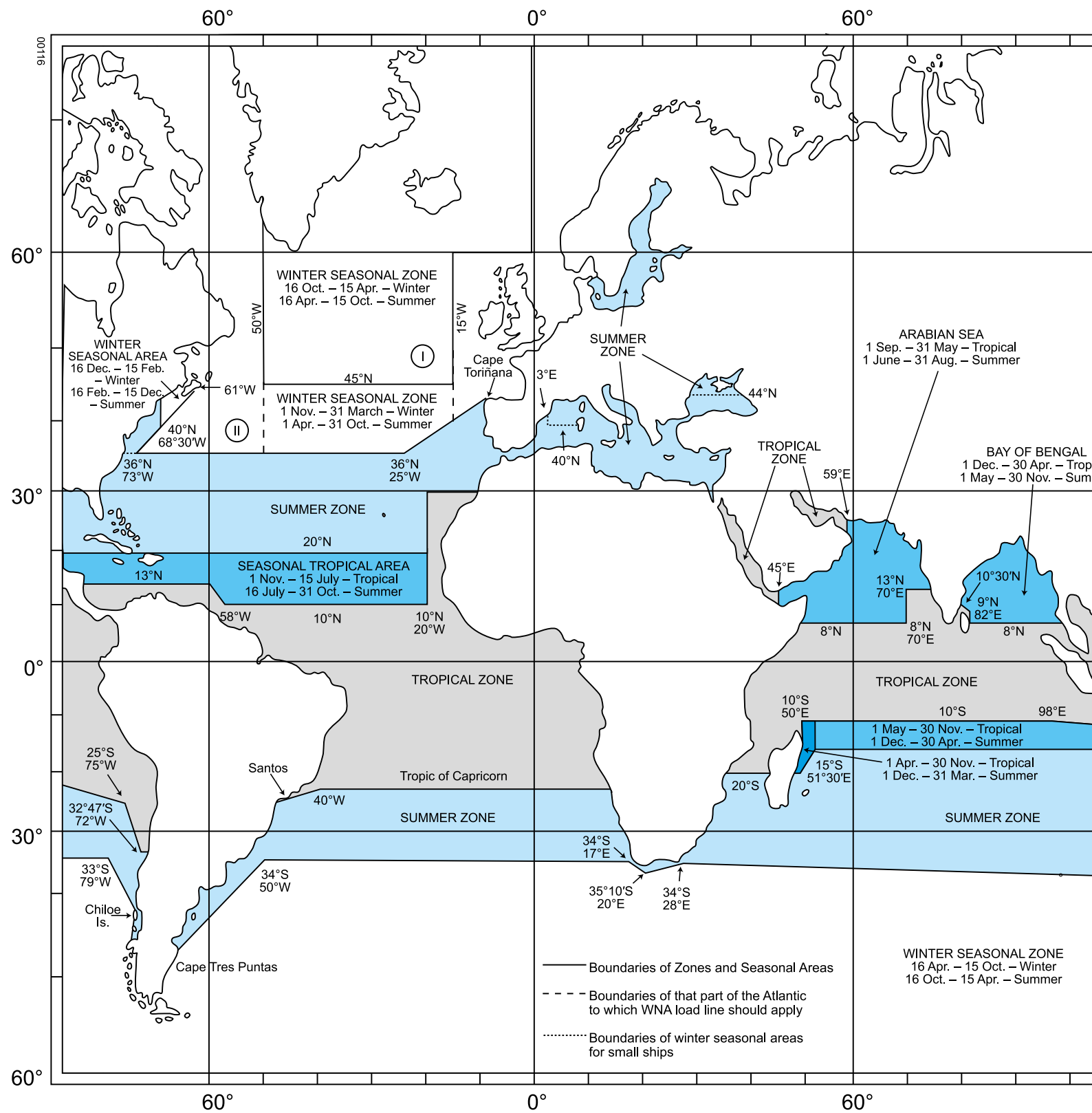


Chart of Zones and Seasonal Areas

1.17 Chart of zones and seasonal areas

The Plimsoll mark indicates the maximum loaded draft allowed for a given level.

The mark (for example, W, S or T) can be determined with the help of the map. During a voyage, the shallowest draft is

always the most important. For example, if a ship leaves in the winter from Northern Spain in a southerly direction, it is possible to reach the summer zone within a few hours.

However, it must still be loaded as if it were in the winter zone.

However, if a specific W, S or T zone is applicable, then it is based entirely on the average expected winds and height of the waves in the area. The cyclone regions are clearly marked in blue with the times they are likely to occur.

Note the WNA mark at the bottom of the map for ships < 100 metres.