

# Loading, Discharging & Trim

## The stowage plan

One of the most important responsibilities of the first mate is to make sure that cargo will be properly loaded and stowed.

Whether bulk cargo, general cargo, heavy cargo, containerized cargoes or refrigerated perishable cargo are carried, care must always be taken to ensure that a cargo will not in any way *affect* the vessel's stability and *jeopardize* vessel, cargo and crew.

Therefore a stowage plan must be made up before the loading of the cargo *commences*.

Stevedoring (loading and discharging of cargo) must be done according to this stowage plan by a shoregang. A shore gang usually consists of a foreman and *stevedores* (longshoremen, as they are called in America), *hatchwaymen*, *winchmen* and a *tally clerk*.

The most important factors that must be taken into *consideration* when making up a stowage plan are:

### 1) The stowage factor of the cargo

This factor indicates the volume of the cargo hold occupied by one ton of cargo and is best explained by this example: one ton of lead will take up less space than one ton of cotton.

According to the type of cargo carried, this volume, or space, can be defined as *bale space*, *grain space* or oil space.

By bale space is meant the volume of the cargo holds that can be used for general cargo.

By grain space is meant the volume of the cargo holds that can be used for dry bulk cargo.

By Oil Space is understood 98% of the total volume of the wet bulk tanks.

The remaining 2 percent is called *ullage* and serves as *expansion-space* to allow for an increase of volume when a cargo of oil is heated up and will consequently expand.

### 2) Trim and draft

By **trim** is understood the transverse and longitudinal positioning of the floating vessel.

To maintain an even transverse balance, the cargo must be *distributed* in such a way that the vessel will not make a *list* to port- or starboard side.

*Longitudinally*, the vessel must not be trimmed in such a way that she will be *down by the head* or *down by the stern* excessively.

Ballast water is used to *improve* the vessel's trim.

To *ensure* a safe voyage of the *laden* vessel, *loadlines* are painted on the sides of the vessel. These loadlines indicate the depths to which the ship may be loaded in different seasons and *circumstances* (tropical fresh water, fresh water, tropical water, in summer, winter and winter North Atlantic).

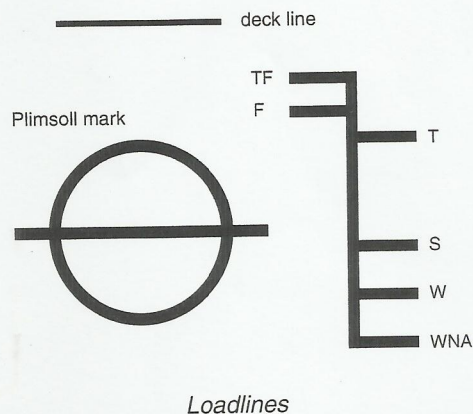
The distance between deckline and Plimsoll line indicates *Summer Freeboard*.

By "*Full and Down*" is meant that the vessel is fully laden and is floating on her load line.

The part of the vessel that is under water is indicated by the word "*draft*" (or "*draught*").

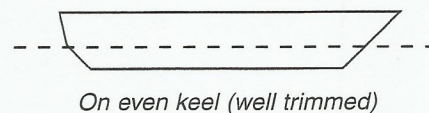
Due to the *salinity* of sea water, draft in sea water is less than draft in fresh water because sea water has a higher *specific gravity* than fresh water.

Draft is measured at the *stern* of the vessel, at the *stem* and amidships.

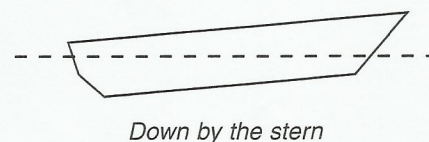




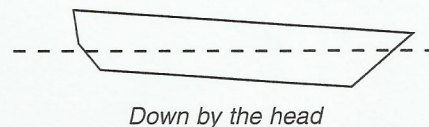
When there is no difference between draft fore and draft aft she is floating on *even keel* (she is *well trimmed*).



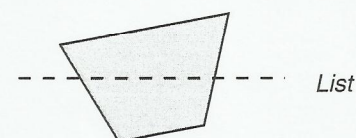
When draft aft is greater than draft fore she is trimmed (or "down"-) by the stern. General safety and *the engine's fuel consumption* will be *influenced* favourably when she is slightly trimmed by the stern.



When draft fore is greater than draft aft she is trimmed (or "down"-) by the head.



When starboard-draft is less than port-draft, or port-draft is less than starboard-draft, she will make a list to port or starboard.



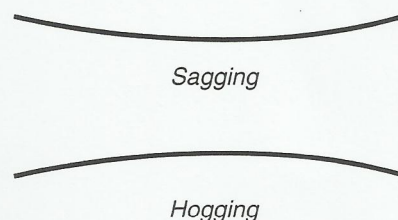
The *longitudinal deformations* of the vessel are indicated by the words "*sagging*" and "*hogging*".

When draft amidships is greater than draft foreward and aft, the vessel is "*sagging*".

This will occur when the vessel is in loaded condition or is in a *trough* between two high waves.

When draft amidships is less than draft foreward and aft, the vessel is "*hogging*". This will *occur* when the vessel is on top of a wave.

Properly laden vessels will suffer less from sagging and hogging effects than vessels whose cargoes have been badly stowed.



Draft is also influenced by the speed at which the vessel is proceeding.

At a certain speed in shallow water the vessel will create a trough at both starboard- and port sides in which she will slightly "sink down".

This phenomenon is called "*squat*".

### 3) Segregation of different cargoes

Some cargoes are notorious for causing damage to the ship and other cargo that is carried.

*Sweating* and *intermixing* of cargoes must therefore be avoided by *segregating* the different types of cargoes.

- Heavy cargo should not be stowed onto light cargo
- wet cargo should not be stowed onto dry cargo
- cargoes whose qualities may be deteriorated by each other's odours should not be stowed close together
- optional cargoes (cargoes whose destinations are unknown at the moment of loading) must be stowed separately
- perishable cargoes should be stowed in refrigerated stowage spaces.

Material used to segregate different types of cargoes is called dunnage. It may consist of ropes, planks, plastics, inflatables, etc.

*Wood dunnage* is used with bale-cargoes to raise the bales a little from the floor for ventilation, so that sweating-water can freely flow to the *bilges* as quickly as possible.

When loading or discharging any type of cargo, care must be taken to follow the cargo-handling instructions most accurately to prevent any damage.

The following instructions are most commonly used:

**"fragile", "use no hooks", "stow away from boilers", "don't tip", "this side up", "keep dry" and "handle with care".**

This latter cargo-handling instruction is often followed by the specific characteristic of the cargo item, e.g. **"explosive", "flammable", "oxidizing", "harmful", "corrosive", "poisonous" (or "toxic"), "spontaneously combustible", "dangerous when wet", "infectuous" or "radio active".**

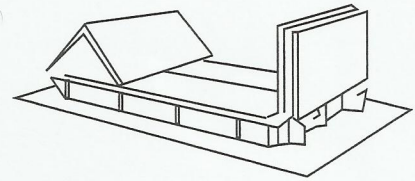
These substances, or "agents", must all be considered as Dangerous Goods".

#### 4) The order of destinations

It would be bad seamanship if, on a voyage from Hamburg to Rotterdam and *thence* to Antwerp, the cargo that has Antwerp as its destination must be discharged first in order to be able to reach the Rotterdam-cargo.

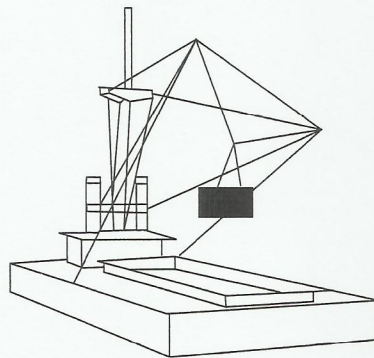
## Cargoes

**General cargo** is cargo coming in boxes, crates, bags and pieces. The stowage plan will indicate where the various cargo-items have been stowed in an ordinary general-cargo ship.



Access to the holds is via hatches

*Union purchase* (or "married gear") is a method of general-cargo-handling with two derricks and one runner in between.



Union purchase ("married gear")

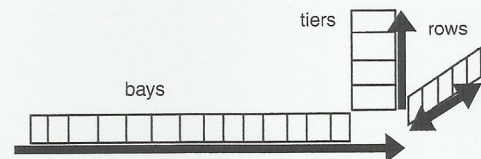
Nowadays most of the general cargo is containerized.

Containers are loaded by *gantry cranes* or *straddle carriers* (portal cranes) and *stacked* on board in rows, bays and tiers.



High-speed straddle carrier

The rows run abeam; the bays run fore to aft; the tiers are layers.



**Bulk cargo** is unpacked cargo of one commodity.

Wet bulk cargo, such as crude oil, *edible oils*, etc. is *loaded and discharged* by pumps.

Dry bulk cargo is loaded and discharged by cranes with grabs or by pumps.