

## IVR TECHNICAL LEAFLET

### STABILITY OF INLAND NAVIGATION VESSELS

#### LEGISLATION

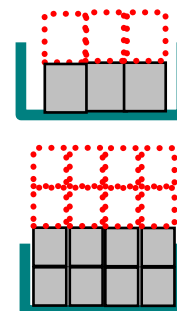
Inland navigation legislation is clear where stability is concerned. In the Police Regulations for the Navigation of the Rhine (RPR) is stated;

- (art. 1.07 sub 4.) *The way of loading may never endanger the stability nor the rigidity of the hull.*
- (art. 1.07 sub 5.) *The stability of ships transporting containers must be guaranteed at all times.*

Furthermore; *The skipper must demonstrate that a stability check has been carried out before loading and unloading as well as before departure. The stability check can be performed manually or by means of a loading computer. The result of the stability check and current draft plan must be kept on board and can be consulted at any time.*

A stability check is not required for ships carrying containers when the ship in width;

- a) can load up to three rows of containers and is only loaded with one layer of containers on the cargo hold floor.
- b) loads four or more rows of containers and is only with two layers of containers on the cargo hold floor.



As is shown in both sketches; if one or more containers are indicated in a red dot, a stability check is required

Having a stability book on board is one thing, but really understanding stability is another. In some cases the skipper and crew lack sufficient stability knowledge, which has resulted in serious damages and even deaths in the past.

In this leaflet we will try to give some more insight in stability and give some pointers.

#### WHAT IS STABILITY

Stability is the ability of an object to return in its mechanical equilibrium when it is exerted by an external force when the force ceases to exist.

Outward forces in shipping are, for example:

- give strong rudder,
- strong divisive maneuvering,
- wind, especially lateral wind,
- currents,
- grounding or beaching,
- ingress of water due to leakage,
- cargo which is not placed midship.

Outward forces can also be reinforced by cargo shifts or by flowing liquids.

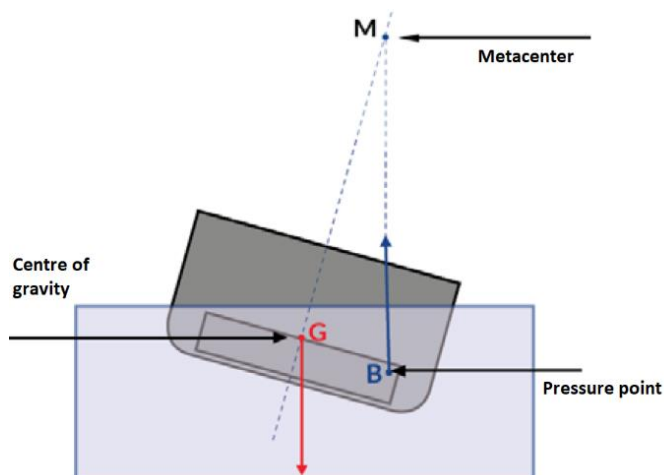
Stability can be subdivided into:

- Initial stability: This is the original stability of the floating object, and is determined by the shape and weight distribution of the ship.
- Static stability : This is the ability of the ship to return to its original equilibrium when it ceases to exist, if it is brought out of power by its external force.
- Dynamic stability: This is the force that has to be applied to the ship to get a certain slope (for example wind or shift of load).

Starting stability can determine the initial values of the stability of the ship. In the drawing below, the forces that play a role in stability are simplified.

In the drawing, the upward pressure (B) and the weight (G) will form a torque that will bring the ship back to its starting position (no tilting). If the center of gravity is not in the plane of the keel and stern and stem, the ship will have a degree of tilt.

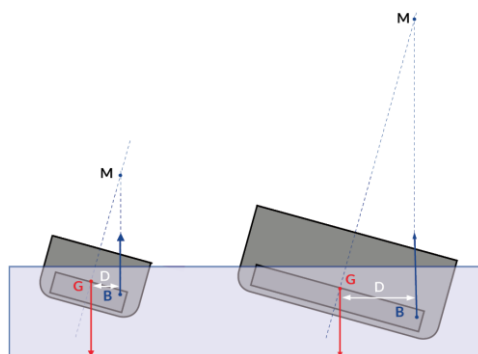
In general, a ship has a positive stability if the metacenter (M) is higher than the (ship) center of gravity (G). If the center of gravity and metacenter coincide, there is "indifferent stability" which results in a labile equilibrium. If the metacenter falls below the ship's center of gravity, stability is negative and will turn a ship.



After the metacenter height (distance G-M) of a ship is determined for a particular load condition, it may need to be adjusted as a result of the presence of free liquid surfaces. These are due to the fact that tanks are not completely filled or because there is water on the load (think of loading sand barge vessels at dredgers).

The magnitude of the distance (D) between that torque of forces (red and blue arrow) is directly proportional to the magnitude of the force.

In other words, a ship with a large width is more stable than a small-width vessel.



## RECOMMENDATIONS

- Knowledge of stability and the associated dangers should be part of the knowledge of the skipper,
- After reconstruction, the ship's stability data should be recalculated and the documentation modified on board.
- Prior to loading, a stability calculation must always be made by the skipper, including the consequences of the free liquid surface.
- Cargo should be well secured bearing in mind it can slip or slide, thus effecting the stability.

## ADDITIONAL INFORMATION

Reference is made to the **CCR Stability Guide**, which, regrettably only available in French, German and Dutch, can be downloaded from the IVR website at [www.ivr-eu.com](http://www.ivr-eu.com).