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INTRODUCTION

The information needed for the calculations includes the following parameters but is not limited to them:

- Detailed drawing of the buoy, included all dimensions and weights.
- Details of the equipment mounted on the buoy, including weights.
- Materials of the different parts of the buoy (float, structure, tail…).
- Specific information on the closed volumes of each piece of the buoy, especially the floats and other submerged equipment.

This article will focus on the calculations and key parameters that ensure buoy buoyancy and stability.

BUOYANCY CALCULATIONS AND PARAMETERS

This calculation ensures that the buoy does not sink. The most important parameter for an AtoN manager in order to evaluate a buoy performance is the Reserve Buoyancy. For the buoy to remain afloat the reserve buoyancy must be positive, higher buoyancy reserve meaning that the buoy could withstand higher additional weights without sinking.

STABILITY CALCULATIONS AND PARAMETERS

Once we have defined the total mass, the buoy general dimensions and the center of buoyancy and gravity, it is possible to calculate the metacentric height (GM). The metacentric height is a key parameter on a buoy stability calculations, providing a measure of the effectiveness of its righting moment, relative to small inclinations of the buoy.

> **Note: For stability calculation, often is considered the worst possible case, the buoy without mooring system. Some buoys (small plastic buoys mostly) need the mooring weight to provide stability and, in this cases, it shall be included on the calculations.**

If metacentric height is positive, the buoy will return to his vertical position when inclined by external forces. If it is negative, the buoy will be unstable, even capsizing in some cases. Therefore, a higher positive metacentric height is desirable in most applications.

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An increase in the metacentric height will improve greatly buoy stability and stabilize the buoy in currents and winds. However, a very big metacentric height can cause a phenomenon where the buoy "copies" the irregularity in the swell, being detriment to the buoy stability in some cases. For this reason, ideal values for metacentric height must be defined. IALA mentions somewhere around 10% of the diameter for steel buoys (with high inertia) and somewhere around 15-35% for plastic buoys (lighter and more easily affected by swell).