

# Ballast Keel Attachment

## 1 Scope

This ICOMIA Standard specifies requirements for the dimensioning, material, and installation of bolts used for fastening external ballast keels to boat hulls.

This standard applies to recreational boats with a length overall (LOA) not exceeding 15.00m.

## 2 References

ICOMIA Standard No. 21: Protection against electrochemical corrosion.

## 3 Definitions

For the purpose of this standard, the following definitions apply.

**3.1 Nominal diameter.** Outside diameter of the threaded part of the keel bolt.

**3.2 Protected against corrosion.** Sheathing galvanically less noble than the parent metal of the keel bolt, or non-metallic bedding compound surrounding the keel bolt.

## 4 Keel Bolts

**4.1** The nominal diameter of the keel bolts  $d_k$  is to be determined from the following formula

$$d_k = 0.7 \sqrt{\frac{wxh}{b}} \times k \text{ in mm}$$

where  $w$  = that portion of the weight of ballast keel supported by the bolt, in Kg

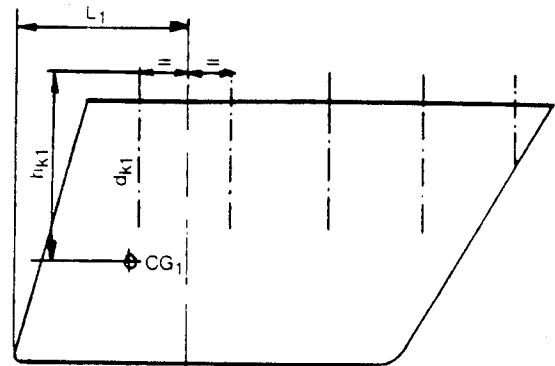
$h_k$  = vertical distance of the centre of gravity of weight  $W$  below top of ballast keel, in mm

$b$  = breadth of top of ballast keel in way of bolt, in mm

$$k = \frac{635}{\sigma_{02} + \sigma_{UT}}$$

where  $\sigma_{02}$  = yield strength, in N/mm<sup>2</sup>

$\sigma_{UT}$  = ultimate tensile strength, in N/mm<sup>2</sup>



$L_1$  = Length of ballast keel to be supported by keel bolt  $k_1$

$CG_1$  = centre of gravity of keel portion

$h_{k1}$  = height of  $CG_1$  below top of keel

$d_{k1}$  = diameter of keel bolt  $k_1$

**4.2** Keel bolts shall be fitted alternatively on opposite sides of the centreline of the keel, if the width of the keel top is sufficient.



**4.3** Where two rows of keel bolts are fitted, the total cross-sectional area of the bolts shall be not less than 1.2 times the cross-sectional area of the bolt determined according to 4.1.



**4.4** If bolts or studs are cast into the ballast keel, the influence of the casting heat has to be considered for the strength values in 4.1.

**4.5** A plate washer shall be fitted under the head or head nut of the keel bolt. The diameter and thickness are to be not less than 4.0 and 0.25 times the bolt diameter, respectively, but the thickness need not exceed 6.0mm.

**4.6** The top of the keel bolt shall have sufficient thread to take double nuts or other suitable locking device.

**4.7** Keel bolts, nuts, and washers shall be of the same material. The material is to be corrosion resistant or has to be protected against corrosion, with regard to the material of the ballast keel. Action against electrochemical corrosion shall be in accordance with ICOMIA Standard No. 21.

## 5 Ballast keel

The top of the ballast keel shall have a plain surface to ensure tight fitting of keel top and hull or deadwood. The joint has to be sealed with a packing or is to be coated by a bedding compound.