

Determination of Density According to Test Method A1 (Two Different Reference Weights Weighed in Air) of OIML R111-1, 2004(E)

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Density of standard weights is one of many parameters that have the influences on the mass determination of the weights. As it is used to calculate the air buoyancy correction, which is an important factor to precisely determine the mass of the weights. According to the International Organization of Legal Metrology (OIML) recommendation R 111-1, 2004(E), there are six accepted methods for the determination of the density of standard weights. Those are methods A, B, C, D, E and F. For the first four method, the test weights are weighed in standard density liquids such as water. Method E determines volume and hence density by geometric measurement, while the density estimation of method F is based on known composition. Among these six methods, method A is the most accurate. Method A uses hydrostatic technique, which compares test weights with reference weights both in air and in liquid of known density. This method can be separated into three methods, which are A1, A2 and A3. However, only method A1 is mentioned in this work. The technique used in method A1 is that the test weight and the first reference weight are firstly compared in air. Then, the test weight in liquid is compared with the second reference weight in air. The test weights used in this work are weights class E having mass between 5 g and 100 g. These weights are manufactured by stainless steel. In this paper, the densities with expanded uncertainty (for $k = 2$) of these test weights are determined and reported. The uncertainties obtained are within specification of OIML R111-1, which is between 1.5 kg.m^{-3} to 60 kg.m^{-3} . The measured densities are compared with those obtained from the method accredited by the Accreditation Body of Deutsche Akkreditierungsstelle (DAkkS), ISO/IEC 17025, on the registration number D-K-15194-01-00. Results obtained from both methods are consistent as shown by En numbers. The absolute En numbers is not greater than 1.0, which is satisfied.

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