UDC 389 : 531.2/.5 : 001.4

January 1988

Mass, as weighed value, force, weight force, weight, load

Concepts

DIN 1305

Masse, Wägewert, Kraft, Gewichtskraft, Gewicht, Last; Begriffe

Supersedes May 1977 edition.

1 Field of application

This standard deals with basic physical quantities and their application in trade and industry.

2 Mass

Mass, m, describes a property of a body that is made evident both by effects of inertia with respect to an alteration to its state of rest or change in its rate of motion, and by the attraction it exerts on other bodies.

3 As weighed value

When a product is weighed in a fluid (liquid or gas) of density ϱ_{fl}, its as weighed value is given by the following relationship:

$$W = m \frac{1 - \frac{\varrho_{fl}}{\varrho}}{1 - \frac{\varrho_{fl}}{\varrho_G}} \quad (1)$$

where ϱ is the density of the product being weighed and ϱ_G is the density of the weights used.

Note. The as weighed value of a product (commodity) is equal to the mass of the weights which keep the weighing machine in equilibrium, or which produce the same indication on the weighing machine as the product weighed.

4 Conventional mass

The conventional mass, W_{std}, is calculated from equation (1) by entering the standard conditions, 1,2 kg/m³ for ϱ_{fl} and 8000 kg/m³ for ϱ_G. For ϱ, the density of the product to be weighed at 20 °C shall be entered.

5 Force

Force, F, is the product of the mass, m, of a body and the acceleration, a, which this experiences or would experience as a result of the force F acting on it:

$$F = m\,a. \quad (2)$$

6 Weight force

The weight force, F_G, of a body of mass m is the product of the mass and the acceleration due to gravity, g:

$$F_G = m\,g. \quad (3)$$

7 Weight

The term 'weight' is used primarily in three senses:

a) instead of 'as weighed value';

b) short for 'weight force';

c) for the weights used in weighing (see DIN 8120 Part 2).

To reduce the risk of ambiguity, the term 'weight' shall not be used where 'weight force' and 'as weighed value' are the appropriate terms.

8 Load

In technical contexts, the term 'load' is used in a variety of different senses (e.g. for 'power', for 'force', or for material objects).

If there is a risk of ambiguity, use of the term 'load' shall be avoided.

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Standard referred to

DIN 8120 Part 2 Concepts relating to weighing machines; concepts relating to components and devices used in weighing machines

Other relevant standards and documents

DIN 8120 Part 1 Concepts relating to weighing machines; classification and concepts

DIN 8120 Part 3 Concepts relating to weighing machines; concepts relating to measurement and calibration (verification)

International Recommendation No. 33, Conventional value of results obtained by weighing in air; issued by International Organization of Legal Metrology, 11, rue Turgot, F-75009 Paris.

Amendments

The following amendments have been made to the May 1977 edition.

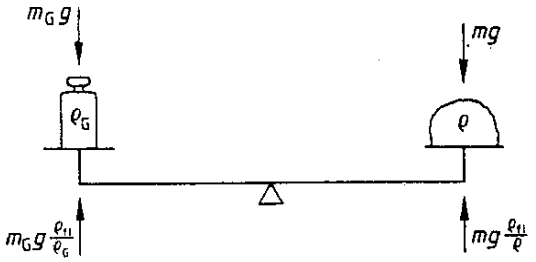
a) The concepts 'as weighed value' and 'conventional mass' have been introduced.

b) The rules relating to the use of the terms 'weight' and 'load' have been revised.

Explanatory notes

Whatever we weigh is affected by the ocean of air on the bed of which we live. Yet hardly ever is a correction made when weighing, as should by rights be made, for the buoyancy of air. In almost all cases, the uncorrected value of the measurement is accepted and also serves as the basis for trade calculations when goods are sold by weight. There is, however, a necessary distinction to be drawn between the mass of a body and the result of weighing it in air, the as weighed value. In weighings of low density products, such as mineral oils, the relative difference between mass and as weighed value roughly amounts to one per thousand. In the case of high density products, the difference is greater. The as weighed value of air is zero. Bodies having the same mass but different densities also give different as weighed values. The as weighed value of a body is further a function of the density of the ambient air and of the prevailing weather conditions.

In formulating equation (1), the assumption was made that on both sides of the weighing machine the sums of weight forces and lifting forces are equal:



$$m_G\, g \left(1 - \frac{\varrho_{fl}}{\varrho_G}\right) = m\, g \left(1 - \frac{\varrho_{fl}}{\varrho}\right) \qquad (4)$$

The mass of the weight, m_G, is assigned to the product weighed as its as weighed value:

$$m_G = W\,. \qquad (5)$$

The product weighed may also be a weight. To enable a constant as weighed value, the conventional mass, to be assigned to a weight, desired values for the density of weights and the ambient air density have been introduced.

If, after manufacture, the density of the weights does not correspond exactly to the desired value of 8000 kg/m^3, then the masses of the weights shall be altered until the conventional masses correspond to the desired values. If the density of the weights is exactly 8000 kg/m^3, then their conventional masses are equal to their masses. The markings on weights indicate the nominal values of their conventional masses.

The mass of the product being weighed is calculated from the as weighed value on the basis of equation (1). If standard weights, or weights conforming to the weights and measures regulations, or weighing machines that have been adjusted using such weights, are used, then 8000 kg/m^3 shall be entered in the equation for ϱ_G, and the conventional mass, W_{std}, of the weights instead of W. The error which this produces in the determination of the mass is small as compared with the limits of error of the weights.

International Patent Classification

G 01 G 1/00