Dictionary of Weighing Terms

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A Guide to the Terminology of Weighing

Springer

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Preface

This Dictionary of Weighing Terms is a comprehensive practical guide to the terminology of weighing for all users of weighing instruments in industry and science. It explains more than 1000 terms of weighing technology and related areas; numerous illustrations assist understanding. The Dictionary of Weighing Terms is a joint work of the German Federal Institute of Physics and Metrology (PTB) and METTLER TOLEDO, the weighing instruments manufacturer. Special thanks go to Peter Brandes, Michael Denzel, and Dr. Oliver Mack of PTB, and to Richard Davis of BIPM, who with their technical knowledge have contributed to the success of this work.
The Dictionary contains terms from the following fields: fundamentals of weighing, application and use of weighing instruments, international standards, legal requirements for weighing instruments, weighing accuracy. An index facilitates rapid location of the required term.
The authors welcome suggestions and corrections at www.mt.com/weighing-terms.

Braunschweig (DE) and Greifensee (CH),
The Authors Summer 2009

Foreword

Since its founding in 1875, the International Bureau of Weights and Measures (BIPM) has had a unique role in mass metrology. The definition of the kilogram depends on an artefact conserved and used within our laboratories. The mass embodied in this artefact defines the kilogram, and this information is disseminated throughout the world to promote uniformity of measurements. Although the definition of the kilogram may change in the relatively near future, reflecting the success of new technologies and new requirements, the task of ensuring world-wide uniformity of mass measurements will remain.
But uniformity is not achieved through standards alone. In all areas of metrology, we seek a common language for referring to the apparatus we use, the rules we follow and the results we present. The field of mass metrology, or weighing, is vast and few of us have the time to become expert in all its areas. The Dictionary of Weighing Terms, with more than 1000 entries, will help bring clarity to this important area of metrology.

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Abbreviations

The following abbreviations are used in this document:

→	cross-reference
a.k.a.	also known as
e.g.	for example
i.e.	that is
PC	Personal Computer
EC	European Community
EU	European Union
EEC	European Economic Community
EEA	European Economic Area

1999/92/EC
Directive 1999/92/EC of the European Parliament and of the Council of 16 December 1999 on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres. →ATEX 137 Directive

2003/94/EC
Commission Directive 2003/94/EC of 8 October 2003 laying down the principles and guidelines of →Good Manufacturing Practice in respect of medicinal products for human use and investigational medicinal products for human use.

2004/10/EC
Directive 2004/10/EC of the European Parliament and of the Council of 11 February 2004 on the harmonisation of laws, regulations and administrative provisions relating to the application of the principles of good laboratory practice and the verification of their applications for tests on chemical substances. →Good Laboratory Practice

2004/108/EC
Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to →electromagnetic compatibility and repealing Directive →89/336/EEC.

2004/22/EC
Directive 2004/22/EC of the European Parliament and of the Council of 31 March 2004 on measuring instruments. →Measuring Instruments Directive

2004/9/EC
Directive 2004/9/EC of the European Parliament and of the Council of 11 February 2004 on the inspection and verification of →Good Laboratory Practice (GLP).

2006/42/EC
Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC.

2006/95/EC
Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits. →Low Voltage Directive

2009/23/EC
Directive 2009/23/EC of the European Parliament and of the Council of 23 April 2009 on non-automatic weighing instruments. →Directive on Non-Automatic Weighing Instruments, →90/384/EEC

71/317/EEC
Council Directive 71/317/EEC of 26 July 1971 on the approximation of the laws of the Member States relating to 5 to 50 kilogramme medium accuracy rectangular bar weights and 1 to 10 kilogramme medium accuracy cylindrical weights. →Directive on Medium Accuracy Weights

73/23/EEC
Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits. This directive was replaced by Directive →2006/95/EC on 16 January 2007. →Low Voltage Directive

74/148/EEC
Council Directive 74/148/EEC of 4 March 1974 on the approximation of the laws of the Member States relating to weights of from 1 mg to 50 kg of above-medium accuracy. →Directive on Above-Medium Accuracy Weights

76/211/EEC
Council Directive 76/211/EEC of 20 January 1976 on the approximation of the laws of the Member States relating to the making-up by weight or by volume of certain prepackaged products. →Prepackaged Products Directive

89/336/EEC
Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility. This directive was replaced by Directive →2004/108/EC on 20 July 2007.

90/384/EEC
Council Directive 90/384/EEC of 20 June 1990 on the harmonization of the laws of the Member States relating to →non-automatic weighing instruments. This directive was replaced by directive →2009/23/EC on 5 June 2009. →Directive on Non-Automatic Weighing Instruments

94/9/EC
Directive 94/9/EC of the European Parliament and the Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres. →ATEX 95 Directive

98/37/EC
Directive 98/37/EC of the European Parliament and of the Council of 22 June 1998 on the approximation of the laws of the Member States relating to machinery. This directive was replaced by directive →2006/42/EC on 29 December 2009. →Machinery Directive

A/D converter
→analog-digital converter

abbreviations
Weighing terms established by national and international regulations, standards, and agreements. Examples: →verification scale interval e, →number of scale intervals d, →maximum capacity Max, →minimum load Min, →accuracy class Ⓘ, Ⓘ, Ⓘ, Ⓘ or →number of verification scale intervals n.

ability of being verified
A measuring device or instrument (→balance, →weight piece) can be verified if it is generally approved for national verification or for →EC verification, if it satisfies the applicable verification requirements or if its design is approved for verification by the competent authorities. →admission to verification

Above-Medium Accuracy Weights Directive
Above-Medium Accuracy Directive →74/148/EEC

absolute weighing
Determination of the →mass or →conventional mass and indication of its measurement value in integrals, fractions, and multiples of the mass of the →International Prototype of the Kilogram. If greater accuracy is required when weighing in air, an →air buoyancy correction is necessary.

absorption
1. Process in which a solid body takes up another substance, a gas or a liquid, into itself. →weighing error (compare: →adsorption, →desorption)
2. Attenuation of electromagnetic radiation (radiation absorption) by transformation into heat. →physical weighing principle 3.1

acceleration due to gravity
If the surface that supports a body is removed, the body can fall freely. The →weight force that acts on the body causes it to accelerate. Since the inertial and gravitational →mass of a body are identical (→equivalence principle), the acceleration is equal to the →gravity and is given by

$$a = g \approx 9.81 \text{ m/s}^2.$$

The variation of →local gravity is primarily a function of the geographical latitude and elevation of the →place of installation.

acceptable amount, smallest
→smallest acceptable amount

accreditation
Formal recognition of the technical and organizational competence of a calibration, testing, inspection, or certification laboratory to perform a specific service within the scope of the accreditation according to internationally governing standards. In many cases, accreditation is according to ISO 17025 "General requirements for the competence of testing and calibration laboratories".

accuracy
1. Closeness of agreement between a measured quantity value and a true quantity value of a measurand ([VIM:2008] 2.13).
2. Qualitative designation for the closeness of the approximation of determined results to the reference value. The reference value may be defined or agreed to be the true value or the expected value [DIN 55350-13]. →error limits
3. The closeness of agreement between a test result and the accepted reference value ([ISO 5725] 3.6). Example: Ability of a measuring instrument to deliver output quantities that are close to the true value ([VIM:1993] 5.18). For repeated measurements, accuracy requires →trueness (absence of →systematic errors) and →precision. For a single measurement, this need not necessarily be the case (Fig. 1).
4. The property of the stated values of weight pieces to correspond to their true value (→accuracy classes of weight pieces).
5. The property of the →measurement value of a weighing instrument to correspond to the value of the load on the instrument (→accuracy classes of weighing instruments).

accuracy class, higher
→higher accuracy class

accuracy classes
Classification of various types of →weighing instruments, or →weight pieces, into classes of the same accuracy. →weight classes, →accuracy classes of weighing instruments, →accuracy classes of weight pieces