



SLOVENSKI STANDARD

SIST EN 45501:2015

01-april-2015

Nadomešča:

SIST EN 45501:1995+AC:1996

Meroslovni vidiki neavtomatskih tehtnic

Metrological aspects of non-automatic weighing instruments

Metrologische Aspekte der nichtselbsttätigen Waagen

Aspects métrologiques des instruments de pesage à fonctionnement non automatique

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ICS:

| | | |
|--------|--|---|
| 17.060 | Merjenje prostornine, mase, gostote, viskoznosti | Measurement of volume, mass, density, viscosity |
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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 45501

February 2015

ICS 17.100

Supersedes EN 45501:1992

English Version

Metrological aspects of non-automatic weighing instruments

Aspects métrologiques des instruments de pesage à
fonctionnement non automatique

Metrologische Aspekte der nichtselbsttätigen Waagen

This European Standard was approved by CENELEC on 30 June 2014. CEN and CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

This document (EN 45501:2015) has been prepared by a Joint CEN/CENELEC Working Group on Non-automatic Weighing Instruments.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-08-13
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2015-08-13

This document supersedes EN 45501:1992.

EN 45501:2015 includes the following significant technical changes with respect to EN 45501:1992:

In preparing this European Standard, EN 45501:1992 which formed the basis of this standard, was considered, but with additions and amendments to take into account the developments in technology which have occurred in the intervening years. Significant changes include, extensions to the EMC immunity requirements to reflect the greater use of wireless technology for many purposes, enhanced specifications for the integrity and security of software and testing regimes to confirm compliance, requirements for portable and mobile instruments, and recognition of the use of modular elements in families of instruments with enhanced testing requirements for both analog and digital modules and systems for confirming the compatibility of modules when combined into a single instrument or system.

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This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive see informative Annex ZZ, which is an integral part of this document.

Introduction

This European Standard has been adapted from the OIML Recommendation R 76-1, Edition 2006, *Non-automatic weighing instruments - Part 1: Metrological and technical requirements - Tests* by a Joint Working Group from CEN and CENELEC. It was elaborated following a standardization request from the Commission of the European Communities to CEN and CENELEC to establish a European Standards related to Council Directive 2009/23/EC on Non-automatic weighing instruments.

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Terminology

(terms, definitions and references)

The terminology used in this standard conforms to the “International Vocabulary of Basic and General Terms in Metrology” (VIM) [1], the “International Vocabulary of Terms in Legal Metrology” (VIML) [2]. In addition, for the purposes of this standard, the following definitions apply. An index of all the terms, definitions and references defined below can be found under T.8.

T.1 General definitions

T.1.1 Weighing instrument

Measuring instrument that serves to determine the mass of a body by using the action of gravity on this body.

NOTE In this standard “mass” (or “weight value”) is preferably used in the sense of “conventional mass” or “conventional value of the result of weighing in air”, according to OIML R111 or D28 whereas “weight” is preferably used for an embodiment (i.e. material measure) of mass that is regulated in regard to its physical and metrological characteristics.

The instrument may also be used to determine other quantities, magnitudes, parameters or characteristics related to the determined mass.

According to its method of operation, a weighing instrument is classified as an automatic weighing instrument or a non-automatic weighing instrument.

T.1.2 Non-automatic weighing instrument

Instrument that requires the intervention of an operator during the weighing process to decide that the weighing result is acceptable. (standards.iteh.ai)

NOTE 1 Deciding that the weighing result is acceptable includes any intelligent action by the operator that affects the result, such as taking an action when an indication is stable or adjusting the mass of the weighed load, and to make a decision regarding the acceptance of each weighing result on observing the indication or releasing a print out. A non-automatic weighing process allows the operator to take an action (i.e. adjust the load, adjust the unit price, determine that the load is acceptable, etc.) which influences the weighing result in the case where the weighing result is not acceptable.

A non-automatic weighing instrument may be

- graduated or non-graduated, or
- self-indicating, semi-self-indicating or non-self-indicating.

NOTE 2 In this standard a non-automatic weighing instrument is called an “instrument”.

T.1.2.1 Graduated instrument

Instrument allowing the direct reading of the complete or partial weighing result.

T.1.2.2 Non-graduated instrument

Instrument not fitted with a scale numbered in units of mass.

T.1.2.3 Self-indicating instrument

Instrument in which the position of equilibrium is obtained without the intervention of an operator.

T.1.2.4 Semi-self-indicating instrument

Instrument with a self-indicating weighing range, in which the operator intervenes to alter the limits of this range.

T.1.2.5 Non-self-indicating instrument

Instrument in which the position of equilibrium is obtained entirely by the operator.

T.1.2.6 Electronic instrument

Instrument equipped with electronic devices.

T.1.2.7 Instrument with price scales

Instrument that indicates the price to pay by means of price charts or scales related to a range of unit prices.

T.1.2.8 Price-computing instrument

Instrument that calculates the price to pay on the basis of the indicated weight value and the unit price.

T.1.2.9 Price-labeling instrument

Price-computing instrument that prints the weight value, unit price and price to pay for prepackages.

T.1.2.10 Self-service instrument

Instrument that is intended to be operated by the customer.

T.1.2.11 Mobile instrument

Non-automatic weighing instrument mounted on or incorporated into a vehicle.

NOTE 1 A vehicle-mounted instrument is a complete weighing instrument which is firmly mounted on a vehicle, and which is designed for that special purpose.

EXAMPLE 1: Postal scale mounted on a vehicle (mobile post office).

NOTE 2 A vehicle-incorporated instrument uses parts of the vehicle for the weighing instrument.

EXAMPLE 2: Garbage weighers, patient lifters, pallet lifters, fork lifters, wheel chair weighers.

T.1.2.12 Portable instrument for weighing road vehicles

Non-automatic weighing instrument having a load receptor, in one or several parts, which determines the total mass of road vehicles and which is designed to be moved to other locations.

EXAMPLES: Portable weighbridge, group of associated non-automatic axle (or wheel) load weighers.

NOTE This standard covers only weighbridges and groups of associated non-automatic axle (or wheel) load weighers that determine simultaneously the total mass of a road vehicle with all axles (or wheels) being simultaneously supported by appropriate parts of a load receptor.

T.1.2.13 Grading instrument

Instrument which assigns a weighing result to a predetermined range of mass to determine a tariff or toll.

EXAMPLES: Postal scales, garbage weighers.

T.1.3 Indications of an instrument

Value of a quantity provided by a measuring instrument.

NOTE "Indication", "indicate" or "indicating" includes both displaying and/or printing.

T.1.3.1 Primary indications

Indications, signals and symbols that are subject to requirements of this European Standard.

T.1.3.2 Secondary indications

Indications, signals and symbols that are not primary indications.

T.2 Construction of an instrument

In this standard the term “device” is used for any means by which a specific function is performed, irrespective of the physical realization, e.g. by a mechanism or a key initiating an operation. The device may be a small part or a major portion of an instrument.

T.2.1 Main devices

T.2.1.1 Load receptor

Part of the instrument intended to receive the load.

T.2.1.2 Load-transmitting device

Part of the instrument for transmitting the force produced by the load acting on the load receptor to the load-measuring device.

T.2.1.3 Load-measuring device

Part of the instrument for measuring the mass of the load by means of an equilibrium device for balancing the force coming from the load transmitting device, and an indicating or printing device.

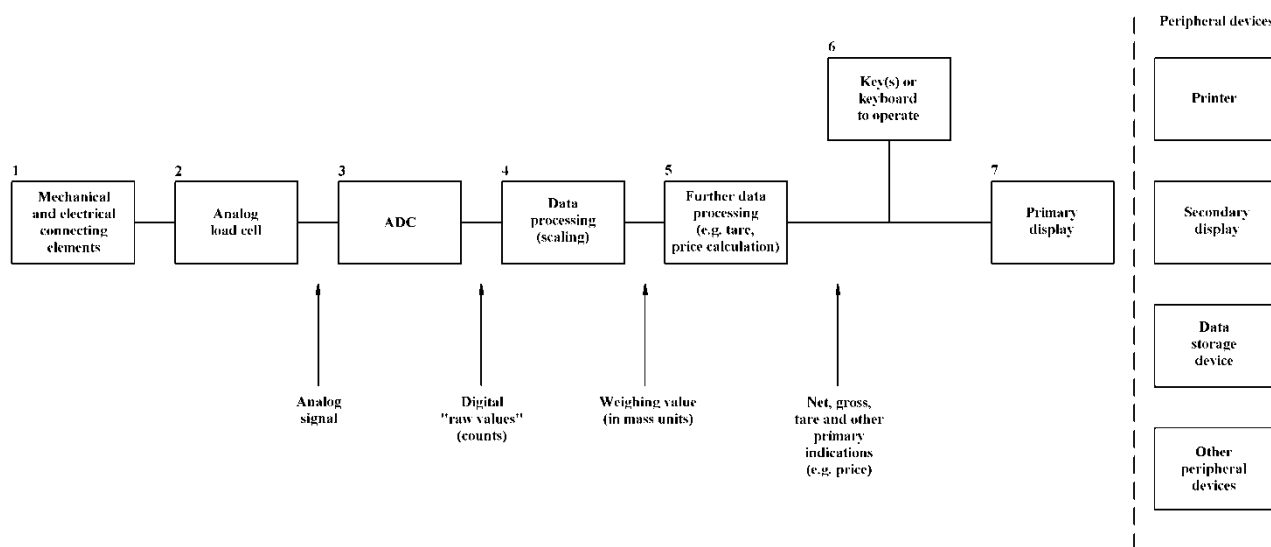
T.2.2 Module

Identifiable part of an instrument that performs a specific function or functions, and that can be separately evaluated in accordance with specific metrological and technical performance requirements in the relevant standard. The modules of a weighing instrument are subject to specified partial error limits.

NOTE Typical modules of a weighing instrument are: load cell, indicator, analog or digital data processing device, weighing module, terminal, primary display.

Evaluation Certificates and Parts Certificates in accordance with this standard can be issued for the modules mentioned in T.2.2.2 to T.2.2.7.

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|--|-----------|---------------------------|
| Analog load cell | (T.2.2.1) | 2 |
| Digital load cell | (T.2.2.1) | 2 + 3 + (4)* |
| Indicator | (T.2.2.2) | (3) + 4 + (5) + (6) + 7 |
| Analog data processing device | (T.2.2.3) | 3 + 4 + (5) + (6) |
| Digital data processing device | (T.2.2.4) | (4) + 5 + (6) |
| Terminal | (T.2.2.5) | (5) + 6 + 7 |
| Primary display | (T.2.2.6) | 7 |
| Weighing module | (T.2.2.7) | 1 + 2 + 3 + 4 + (5) + (6) |
| NOTE Numbers in brackets indicate options. | | |

**Figure 1 - Definition of typical modules according to T.2.2 and 3.10.2
(other combinations are possible)**

T.2.2.1 Load cell

Force transducer which, after taking into account the effects of the acceleration of gravity and air buoyancy at the location of its use, measures mass by converting the measured quantity (mass) into another measured quantity (output).

NOTE Load cells equipped with electronics including amplifier, analog-to-digital converter (ADC), and data processing device (optionally) are called digital load cells (see Figure 1).

T.2.2.2 Indicator

Electronic device of an instrument that may perform the analog-to-digital conversion of the output signal of the load cell, and which further processes the data, and displays the weighing result in units of mass.

T.2.2.3 Analog data processing device

Electronic device of an instrument that performs the analog-to-digital conversion of the output signal of the load cell, further processes the data, and supplies the weighing result in a digital format via a digital interface without displaying it. It may optionally have one or more keys (or mouse, touch-screen, etc.) to operate the instrument.

T.2.2.4 Digital data processing device

Electronic device of an instrument that further processes the data, and supplies the weighing result in a digital format via a digital interface without displaying it. It may optionally have one or more keys (or mouse, touch-screen, etc.) to operate the instrument.

T.2.2.5 Terminal

Digital device that has one or more keys (or mouse, touch-screen, etc.) to operate the instrument, and a display to provide the weighing results transmitted via the digital interface of a weighing module or an analog data processing device.

T.2.2.6 Digital display

A digital display can be realized as a primary display or as a secondary display:

- a) Primary display: Either incorporated in the indicator housing or in the terminal housing or realized as a display in a separate housing (i.e. terminal without keys), e.g. for use in combination with a weighing module;
- b) Secondary display: Additional peripheral device (optional) which repeats the weighing result and any other primary indication, or provides further, non-metrological information.

The terms “primary display” and “secondary display” should not be confused with the terms “primary indication” and “secondary indication” (T.1.3.1 and T.1.3.2).

T.2.2.7 Weighing module

Part of the weighing instrument that comprises all mechanical and electronic devices (i.e. load receptor, load-transmitting device, load cell, and analog data processing device or digital data processing device) but not having the means to display the weighing result. It may optionally have devices for further processing (digital) data and operating the instrument.

T.2.3 Electronic parts**T.2.3.1 Electronic device**

Device employing electronic sub-assemblies and performing a specific function.

Electronic devices are usually manufactured as separate units and are capable of being tested independently.

NOTE An electronic device, as defined above, may be a complete instrument (e.g. an instrument for direct sales to the public), a module (e.g. indicator, analog data processing device, weighing module) or a peripheral device (e.g. printer, secondary display).

T.2.3.2 Electronic sub-assembly

Part of an electronic device, employing electronic components and having a recognizable function of its own.

EXAMPLES: A/D converter, display.

T.2.3.3 Electronic component

Smallest physical entity that uses electron or hole conduction in semi-conductors, gases or in a vacuum.

EXAMPLES: Electronic tube, transistor, integrated circuit.

T.2.3.4 Digital device

Electronic device that only performs digital functions and provides a digitized output or display.

EXAMPLES: Printer, primary or secondary display, keyboard, terminal, data storage device, personal computer.

T.2.3.5 Peripheral device

Additional device which repeats or further processes the weighing result and other primary indications.

EXAMPLES: Printer, secondary display, keyboard, terminal, data storage device, personal computer.

T.2.3.6 Protective interface

Interface (hardware and/or software) which only allows the introduction of such data into the data processing device of an instrument, module or electronic component, which cannot

- display data which are not clearly defined and which could be taken for a weighing result,
- falsify displayed, processed or stored weighing results or primary indications, or
- adjust the instrument or change any adjustment factor, except releasing an adjustment procedure with incorporated devices or, in the case of class I instruments with external adjustment weights as well.

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T.2.4 Displaying device (of a weighing instrument)

Device providing the weighing result in visual form.

T.2.4.1 Displaying component

Component that displays the equilibrium and/or the result.

- on an instrument with one position of equilibrium it displays only the equilibrium.
- on an instrument with several positions of equilibrium it displays both the equilibrium and the result.

T.2.4.2 Scale mark

Line or other mark on a displaying component corresponding to a specified value of mass.

T.2.5 Auxiliary indicating devices**T.2.5.1 Rider**

Detachable poise of small mass that may be placed and moved either on a graduated bar integral with the beam or on the beam itself.

T.2.5.2 Device for interpolation of reading (vernier or nonius)

Device connected to the displaying component and sub-dividing the scale of an instrument, without special adjustment.

T.2.5.3 Complementary displaying device

Adjustable device by means of which it is possible to estimate, in units of mass, the value corresponding to the distance between a scale mark and the displaying component.

T.2.5.4 Indicating device with a differentiated scale division

Digital indicating device of which the last figure after the decimal sign is clearly differentiated from other figures.

T.2.6 Extended displaying device

Device temporarily changing the actual scale interval, d , to a value less than the verification scale interval, e , following a manual command.

T.2.7 Supplementary devices

T.2.7.1 Leveling device

Device for setting an instrument to its reference (horizontal) position.

T.2.7.2 Zero-setting device

Device for setting the indication to zero when there is no load on the load receptor.

T.2.7.2.1 Non-automatic zero-setting device

Device for setting the indication to zero by an operator.

T.2.7.2.2 Semi-automatic zero-setting device

Device for setting the indication to zero automatically following a manual command.

T.2.7.2.3 Automatic zero-setting device

Device for setting the indication to zero automatically without the intervention of an operator.

T.2.7.2.4 Initial zero-setting device

Device for setting the indication to zero automatically at the time the instrument is switched on and before it is ready for use.

T.2.7.3 Zero-tracking device

Device for maintaining the zero indication within certain limits automatically.

T.2.7.4 Tare device

Device for setting the indication to zero when a load is on the load receptor

- without altering the weighing range for net loads (additive tare device), or
- reducing the weighing range for net loads (subtractive tare device).

It may function as

- a non-automatic device (load balanced by an operator),
- a semi-automatic device (load balanced automatically following a single manual command), or
- an automatic device (load balanced automatically without the intervention of an operator).

T.2.7.4.1 Tare-balancing device

Tare device without indication of the tare value when the instrument is loaded.

T.2.7.4.2 Tare-weighing device

Tare device that stores the tare value and that is capable of displaying or printing it whether or not the instrument is loaded.

T.2.7.5 Preset tare device