INTERNATIONAL RECOMMENDATION

OIML R 134-1

Edition 2003 (E)

Automatic instruments for weighing road vehicles in motion. Total vehicle weighing

Instruments à fonctionnement automatique pour le pesage des véhicules routiers en mouvement. Pesage total du véhicule

ORGANISATION INTERNATIONALE DE MÉTROLOGIE LÉGALE

INTERNATIONAL ORGANIZATION OF LEGAL METROLOGY

Contents

Foreword

The International Organization of Legal Metrology (OIML) is a worldwide, intergovernmental organization whose primary aim is to harmonize the regulations and metrological controls applied by the national metrological services, or related organizations, of its Member States.

The two main categories of OIML publications are:

- **International Recommendations (OIML R)**, which are model regulations that establish the metrological characteristics required of certain measuring instruments and which specify methods and equipment for checking their conformity; the OIML Member States shall implement these Recommendations to the greatest possible extent;
- **International Documents (OIML D)**, which are informative in nature and intended to improve the work of the metrology services.

OIML Draft Recommendations and Documents are developed by technical committees or subcommittees which are formed by Member States. Certain international and regional institutions also participate on a consultation basis.

Cooperative agreements are established between OIML and certain institutions, such as ISO and IEC, with the objective of avoiding contradictory requirements; consequently, manufacturers and users of measuring instruments, test laboratories, etc. may apply simultaneously OIML publications and those of other institutions.

International Recommendations and International Documents are published in French (F) and English (E) and are subject to periodic revision.

This publication - reference OIML R 134-1 Edition 2003 (E) - was developed by the OIML Technical Subcommittee TC 9/SC 2 *Automatic Weighing instruments*. It was approved for final publication by the International Committee of Legal Metrology in 2002 and will be submitted to the International Conference of Legal Metrology in 2004 for formal sanction.

OIML publications may be obtained from the Organization's headquarters:

Bureau International de Métrologie Légale
11, rue Turgot - 75009 Paris - France
Telephone: 33 (0)1 48 78 12 82
Fax: 33 (0)1 42 82 17 27
E-mail: biml@oiml.org
Internet: www.oiml.org

Terminology

The terminology used in this Recommendation conforms to the *International Vocabulary of Basic and General Terms in Metrology* (VIM - 1993 edition) and to the *International Vocabulary of Terms in Legal Metrology* (VIML - 2000 edition). In addition, for the purposes of this Recommendation, the following definitions apply.

T.1 General definitions

T.1.1 Weighing instrument

Measuring instrument that serves to determine the mass of a load by using the action of gravity (see "dynamic vehicle tyre force").

T.1.2 Automatic weighing instrument

Instrument that weighs without the intervention of an operator and follows a predetermined program of automatic processes characteristic of the instrument.

T.1.3 Automatic instrument for weighing road vehicles in motion

Automatic weighing instrument having (a) load receptor(s), inclusive of aprons, that determines the total mass of a road vehicle by weighing the road vehicle in motion.

T.1.4 Electronic instrument

Instrument equipped with electronic devices.

T.1.5 Control instrument

Weighing instrument used to determine the mass of a reference vehicle.

T.1.6 Weigh zone

Zone comprising the load receptor (T.2.1) with an apron (T.1.6.1) on both ends.

T.1.6.1 Apron

Part of the weigh zone that is not the load receptor but which is located on either end of the load receptor.

T.2 Construction

Note: In this Recommendation the term "device" is applied to any part which uses any means to perform one or more specific functions.

T.2.1 Load receptor

Part of the weigh zone that is identified to receive the load and which realizes a change in the balance of the instrument when a load is placed upon it.

T.2.1.1 Multiple load receptor

Two or more load receptors placed in series that are used as a single load receptor for full draught weighing.

T.2.2 Electronic device

Device comprised of electronic sub-assemblies and performing a specific function. An electronic device is usually manufactured as a separate unit and is capable of being independently tested.

T.2.2.1 Electronic sub-assembly

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

T.2.2.2 Electronic component

Smallest physical entity that uses electron or hole conduction in semiconductors, gases, or in a vacuum.

T.2.3 Indicating device

Part of the instrument that displays the value of a weighing result in units of mass.

T.2.4 Ancillary devices

T.2.4.1 Zero-setting device

Means used to set the weight indicating device to zero when the load receptor is empty.

T.2.4.1.1 Nonautomatic zero-setting device

Zero-setting device that must be operated manually.

T.2.4.1.2 Semi-automatic zero-setting device

Zero-setting device that operates automatically following a manual command.

T.2.4.1.3 Automatic zero-setting device

Zero-setting device that operates automatically and without the intervention of an operator.

T.2.4.1.4 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.2.4.1.5 Zero-tracking device

Device for automatically maintaining the zero indication within certain limits.

T.2.4.2 Printing device

Means to print the weight value of a vehicle weighed on the instrument.

T.3 Metrological characteristics

T.3.1 Weighing

T.3.1.1 Full draught weighing

Determination of the mass of a vehicle that is entirely supported on the load receptor(s).

T.3.1.2 Partial weighing

Weighing of a vehicle in two or more parts successively on the same load receptor. The results are automatically added to indicate or print the vehicle weight.

T.3.1.3 Weighing-in-motion

Process of determining the total mass of a moving vehicle by measurement and analysis of the dynamic vehicle tyre forces.

T.3.1.4 Static weighing

Weighing of vehicles or test loads that are stationary.

T.3.1.5 Dynamic vehicle tyre force

Component of the time-varying force applied perpendicularly to the road surface by the tyre(s) on a wheel of a moving vehicle. In addition to the action of gravity, this force can also include dynamic effects of influences on the moving vehicle.

T.3.2 Capacity

T.3.2.1 Maximum capacity (Max)

Largest load that an instrument is designed to weigh in motion without totalizing.

T.3.2.2 Minimum capacity (Min)

Load below which a weighing-in-motion result before totalizing may be subject to an excessive relative error.

T.3.2.3 Weighing range

Range between the minimum and maximum capacities.

T.3.3 Scale intervals

T.3.3.1 Scale interval (d)

Value expressed in units of mass for weighing-in-motion that is the difference between two consecutive indicated or printed values.

T.3.3.2 Scale interval for stationary load

Value expressed in units of mass for weighing vehicles or test loads that are stationary that is the difference between two consecutive indicated or printed values.

T.3.4 Speed

T.3.4.1 Maximum operating speed (v_{max})

Greatest velocity of a vehicle that the instrument is designed to weigh in motion and above which the weighing results may be subject to an excessive relative error.

T.3.4.2 Minimum operating speed (v_{min})

Lowest velocity of a vehicle that the instrument is designed to weigh in motion and below which the weighing results may be subject to an excessive relative error.

T.3.4.3 Range of operating speeds

Set of values between the minimum and maximum operating speeds at which a vehicle may be weighed in motion.

T.3.4.4 Maximum transit speed

Maximum speed at which a vehicle can travel on the weigh zone without producing a permanent shift in the performance characteristics of a weighing instrument beyond those specified.

T.3.5 Warm-up time

Time between the moment that power is applied to an instrument and the moment at which the instrument is capable of complying with the requirements.

T.3.6 Durability

Ability of an instrument to maintain its performance characteristics over a period of use.

T.4 Indications and errors

T.4.1 Digital indication

Indication in which the scale marks are a sequence of aligned figures that do not permit interpolation to a fraction of the scale interval.

T.4.2 Errors

T.4.2.1 Error (of indication)

Indication of an instrument minus the (conventional) true value of the mass.

T.4.2.2 Intrinsic error

Error of an instrument under reference conditions.

T.4.2.3 Initial intrinsic error

Intrinsic error of an instrument as determined prior to performance tests and durability evaluations.

T.4.2.4 Fault

Difference between the error of indication and the intrinsic error of a weighing instrument.

Note 1: Principally, a fault is the result of an undesired change of data contained in or flowing through an electronic instrument.

Note 2: From the definition it follows that in this Recommendation a "fault" is a numerical value.

T.4.2.5 Significant fault

Fault greater than 1 *d*.

The following are not considered to be significant faults:

- faults that result from simultaneous and mutually independent causes in the instrument or in its checking facility;
- faults that make it impossible to perform any measurement;
- transitory faults that are momentary variations in the indications which cannot be interpreted, memorized or transmitted as a measurement result; and
- faults that are so serious that they will inevitably be noticed by those interested in the measurement.

T.4.2.6 Span stability

Capability of an instrument to maintain the difference between the indication of weight at maximum capacity

and the indication at zero within specified limits over a period of use.

T.4.2.7 Rounding error

Difference between a digital measurement result (indicated or printed) and the value of that measurement result with an analog indication.

T.5 Influences and reference conditions

T.5.1 Influence quantity

Quantity that is not the subject of the measurement but which influences the value of the measurand or the indication of the instrument.

T.5.1.1 Influence factor

Influence quantity having a value within the specified rated operating conditions of the instrument.

T.5.1.2 Disturbance

Influence quantity having a value that falls within the limits specified in this Recommendation but that falls outside the rated operating conditions of the instrument.

T.5.2 Rated operating conditions

Conditions of use which give the ranges of the influence quantities for which the metrological characteristics are intended to lie within the specified maximum permissible errors.

T.5.3 Reference conditions

Conditions of use prescribed for testing the performance of a measuring instrument or for intercomparison of results of measurements.

Note: The reference conditions generally include reference values or reference ranges for influence quantities affecting the measuring instrument. [VIM 5.7]

T.6 Tests

T.6.1 Static test

Test with standard weights or a load that remains stationary on the load receptor to determine an error.

T.6.2 In-motion test

Test with reference vehicles that are in motion on the load receptor to determine an error.

T.6.3 Simulation test

Test carried out on a complete instrument or part of an instrument in which any part of the weighing operation is simulated.

T.6.4 Performance test

Test to verify that the equipment under test (EUT) is capable of accomplishing its intended functions.

T.6.5 Span stability test

Test to verify that the EUT is capable of maintaining its span stability over a period of use.

T.7 Vehicles

T.7.1 Vehicle

Loaded or unloaded vehicle that is recognized by the instrument as a vehicle to be weighed.

T.7.2 Reference vehicle

Vehicle of known weight that is typical of those to be used for weighing on the instrument and which has been selected for the purposes of in-motion testing.

Automatic instruments for weighing road vehicles in motion. Total vehicle weighing

1 General

1.1 Scope

This International Recommendation specifies the requirements and test methods for automatic instruments for weighing road vehicles in motion, hereinafter referred to as "instruments", that are used to determine the total mass of road vehicles when the vehicles are weighed in motion.

It provides standardized requirements and test procedures to evaluate the metrological and technical characteristics of an instrument in a uniform and traceable way.

1.2 Application

This Recommendation applies only to instruments:

- which are installed in a controlled weighing area; and
- where the vehicle speed is controlled.

This Recommendation does not apply to instruments that are installed directly into or onto a normal road surface.

1.3 Terminology

The terminology given on pages 5–8 shall be considered as part of this Recommendation.

2 Metrological requirements

2.1 Accuracy classes

Instruments are divided into six accuracy classes as follows:

0.2 0.5 1 2 5 10

Note: The limitation of accuracy classes to certain applications may be determined by national prescription.

2.2 Maximum permissible errors

2.2.1 Weighing-in-motion

The maximum permissible error for vehicle weighing shall be one of the following values, whichever is greater:

a) the value calculated according to Table 1, rounded to the nearest scale interval;

b) 1 d × the number of weighings in the totalization in the case of initial verification,
2 d × the number of weighings in the totalization in the case of in-service inspection.

Table 1

Accuracy class	Percentage of mass of total vehicle	
	Initial verification	In-service inspection
0.2	± 0.10 %	± 0.20 %
0.5	± 0.25 %	± 0.50 %
1	± 0.50 %	± 1.00 %
2	± 1.00 %	± 2.00 %
5	± 2.50 %	± 5.00 %
10	± 5.00 %	± 10.00 %

2.2.2 Static weighing

The maximum permissible errors on static weighing for increasing or decreasing loads shall be the appropriate values in Table 2.

Table 2

Accuracy class	Load (m), expressed in scale intervals	Maximum permissible errors	
		Initial verification	In-service inspection
0.2 0.5 1	$0 \le m \le 500$	± 0.5 d	± 1.0 d
	$500 < m \le 2000$	± 1.0 d	± 2.0 d
	$2000 < m \le 5000$	± 1.5 d	± 3.0 d
2 5 10	$0 \le m \le 50$	± 0.5 d	± 1.0 d
	$50 < m \le 200$	± 1.0 d	± 2.0 d
	$200 < m \le 1000$	± 1.5 d	± 3.0 d

2.3 Scale interval (d)

For a particular method of weighing-in-motion and combination of load receptors, all weight indicating and printing devices on an instrument shall have the same scale interval.

The relationship between the accuracy class, the value of the scale interval and the number of scale intervals for the maximum capacity of the instrument shall be as specified in Table 3.

Table 3

Accuracy class	d (kg)	Minimum number of scale intervals	Maximum number of scale intervals
0.2	≤ 5	500	5000
0.5	≤ 10		
1	≤ 20		
2	≤ 50	50	1000
5	≤ 100		
10	≤ 200		

The scale intervals of the indicating or printing devices shall be in the form of 1×10^k, 2×10^k or 5×10^k, "k" being a positive or negative whole number or zero.

2.4 Minimum capacity

The minimum capacity shall not be less than the load, expressed in scale intervals, specified in Table 4.

Table 4

Accuracy class	Minimum capacity in scale intervals
0.2 0.5 1	50
2 5 10	10

2.5 Individual axle or axle group loads

Individual axle or axle group loads shall not be indicated or printed without an associated warning that these results cannot be verified.

2.6 Agreement between indicating and printing devices

For the same load, there shall be no difference between the weighing results provided by any two devices having the same scale interval.

2.7 Influence quantities

Refer to Annex A for test conditions.

2.7.1 Temperature

2.7.1.1 Temperature limits

Instruments shall comply with the appropriate metrological and technical requirements at temperatures from – 10 °C to + 40 °C.

For special applications, however, the limits of the temperature range may differ provided that this range shall not be less than 30 °C and shall be specified in the descriptive markings.

2.7.1.2 Temperature effect on no-load indication

The indication at zero or near zero shall not vary by more than one scale interval for a difference in ambient temperature of 5 °C.

2.7.2 Power supply (AC)

Instruments that are powered by an AC supply shall comply with the appropriate metrological and technical requirements when operated under variations of voltage from – 15 % to + 10 % of the value marked on the instrument.

2.7.3 Power supply (DC)

Instruments that are powered by a DC supply shall comply with the appropriate metrological and technical requirements in accordance with 4.3.7.

Instruments shall be tested for compliance with the DC powered instruments tests in A.7.4.

2.8 Units of measurement

The units of mass to be used on an instrument are the kilogram (kg) or the tonne (t).

2.9 Conditions of use

2.9.1 Use as a nonautomatic weighing instrument

An instrument that can be used as a nonautomatic weighing instrument shall meet the requirements of OIML R 76-1 for class III or class IIII nonautomatic weighing instruments.

2.9.2 Scale interval for stationary load

If the scale interval for stationary load is not equal to the scale interval (*d*), it shall be automatically put out of service when the instrument is in use for weighing-in-motion. In addition, if the instrument is not verified for use as a nonautomatic weighing instrument, the scale interval for stationary load shall not be readily accessible and shall only be used for static testing.

3 Technical requirements

3.1 Suitability for use

Instruments shall be designed to suit the vehicles, site and method of operation for which they are intended.

3.2 Security of operation

3.2.1 Fraudulent use

An instrument shall have no characteristics likely to facilitate its fraudulent use.

3.2.2 Accidental maladjustment

Instruments shall be constructed so that maladjustments likely to disturb their metrological performance cannot normally take place without the effect being easily detected.

3.2.3 Interlocks

Interlocks shall prevent the use of any control device that may alter a weighing operation.

3.2.4 Use as a nonautomatic weighing instrument

An instrument to be used as a nonautomatic weighing instrument shall:

- comply with the requirements of OIML R 76-1 for class III or class IIII nonautomatic weighing instruments; and
- be equipped with an enabling device for nonautomatic operation that prevents both automatic operation and in-motion weighing.

3.3 Zeroing devices

3.3.1 Zero-setting

An instrument shall be provided with a zero-setting device which may be automatic or semi-automatic.

A zero-setting device shall be capable of setting zero to within ± 0.25 *d* and shall have a range of adjustment not exceeding 4 % of the maximum capacity. The range of adjustment of the initial zero-setting device shall not exceed 20 % of the maximum capacity.

A semi-automatic zero-setting device shall not be operable during automatic operation.

An automatic and a semi-automatic zero-setting device shall function only when the instrument is in stable equilibrium.

3.3.2 Zero-tracking device

A zero-tracking device shall operate only when:

- the indication is at zero, and
- the instrument is in stable equilibrium, and
- the corrections are not more than 0.5 *d*/second, and
- within a range of 4 % of Max around the actual zero.

3.4 Use as a control instrument

An instrument to be used as a control instrument shall meet the requirements of 6.1.2 and 3.4.1 to 3.4.3 inclusive.

3.4.1 Zero-setting

The instrument shall be capable of setting zero to within ± 0.25 of the scale interval for a stationary load.

3.4.2 Eccentric loading

The indications for different positions of the load shall comply with the maximum permissible errors in 2.2.2 for initial verification for the given load.

3.4.3 Discrimination

An additional load that is equal to 1.4 times the scale interval for a stationary load, when gently placed on or withdrawn from each load receptor in turn when at equilibrium at any load, shall change the initial indication.

3.5 Indicating and printing devices

3.5.1 Quality of indication

The weight indication shall be the self-indicating type. Indicating and printing devices shall allow reliable, simple and unambiguous reading of the results by simple juxtaposition and bear the name or symbol of the appropriate unit of mass.

3.5.2 Printing

The minimum printout resulting from each normal weighing operation shall be the total vehicle weight, the date and the time, and where applicable the number of partial weighings.

3.5.3 Weighing range

Instruments shall not indicate or print the weight of any vehicle where a partial weighing, before totalizing, is less than Min or greater than Max + 9 *d*.

3.5.4 Vehicle guide device

The instrument shall not indicate or print the weight of any vehicle if any of the wheels of that vehicle did not pass fully over the load receptor. Alternatively, a lateral guide system may be used to ensure that the vehicle passes fully over the load receptor.

If only one direction of travel is specified for an instrument, an error message shall be given if a vehicle travels in the wrong direction. Alternatively, barriers or other traffic control methods may be used to prevent vehicles travelling in the wrong direction.

3.5.5 Operating speed

The instrument shall not indicate or print the weight of any vehicle that has travelled over the load receptor:

- at a speed outside the specified range of operating speeds, and/or
- with a speed variation (acceleration/deceleration) that would produce a weighing result that may be subject to an excessive relative error.

3.6 Installation

3.6.1 General

Instruments shall be installed so as to keep the effects of the installation environment on the weighing results to a minimum. Where particular details of installation may have an effect on the weighing operation (e.g. site levels, length of aprons), these details shall be recorded on the type approval certificate.

3.6.2 Drainage

If the weighing mechanism is contained in a pit, there shall be a provision for drainage to ensure that no portion of the instrument becomes submerged or partially submerged in water or any other liquid.

3.7 Sealing devices

3.7.1 General

Preferably, components that are not intended to be adjusted or removed by the user shall be fitted with a sealing device or shall be enclosed. When enclosed, it shall be possible to seal the enclosure. However, other types of sealing are permitted which provide sufficient integrity, e.g. electronic seals.

The seals shall, in all cases, be easily accessible.

Sealing should be provided on all parts of the measuring system which cannot be materially protected in any other way against operations liable to affect the measurement accuracy.

It must be prohibited to change parameters which participate in the determination of the results of measurement (parameters for correction and conversion in particular) by means of sealing devices.

3.7.2 Electronic sealing devices

When access to parameters that participate in the determination of results of measurement is not protected by mechanical sealing devices, the protection shall fulfill the following provisions:

a) access shall only be allowed to authorized people, e.g. by means of a code (key-word) or a special device (hard key, etc); the code must be changeable; and

b) it shall be possible for at least the last intervention to be memorized; the record shall include the date and a characteristic element identifying the authorized person making the intervention (see (a) above); the traceability of the last intervention shall be assured for at least two years, if it is not over-written on the occasion of a further intervention; if it is possible to memorize more than one intervention, and if deletion of a previous intervention must occur to permit a new record, the oldest record shall be deleted.

3.8 Descriptive markings

Instruments shall bear the following basic markings at each location having a weight indicating or printing device.

3.8.1 Markings shown in full

- identification mark of the manufacturer
- identification mark of the importer (if applicable)
- type designation of the instrument
- serial number of the instrument (on each load receptor, if applicable)
- not to be used to weigh liquid products (if applicable)
- maximum transit speed km/h
- direction of weighing (if applicable)
- scale interval for stationary load (if applicable) kg or t
- electric power supply voltage V
- electric power supply frequency Hz
- temperature range (when not – 10 °C to + 40 °C) °C

3.8.2 Markings shown in code

- accuracy class 0.2, 0.5, 1, 2, 5 or 10
- maximum capacity Max = kg or t
- minimum capacity Min = kg or t
- scale interval d = kg or t
- maximum operating speed v_{max} = km/h
- minimum operating speed v_{min} = km/h
- maximum number of axles per vehicle (where applicable) a_{max}
- type approval sign in accordance with national requirements

3.8.3 Supplementary markings

Depending upon the particular use of the instrument, one or more supplementary markings may be required on type approval by the metrological authority issuing the type approval certificate. For example, when a particular instrument is verified using a limited range of vehicles (e.g. air suspension systems only, three/four axle rigid vehicles only), then this should be marked on the instrument.

3.8.4 Presentation of descriptive markings

Descriptive markings shall be indelible and of a size, shape and clarity that permit legibility under normal conditions of use of the instrument.

Markings shall be grouped together in a clearly visible place on the instrument, either on a descriptive plate fixed near the indicating device or on the indicating device itself.

It shall be possible to seal the plate bearing the markings, unless it cannot be removed without being destroyed.

3.9 Verification marks

3.9.1 Position

Instruments shall have a place for the application of verification marks. This place shall:

- be such that the part on which the marks are located cannot be removed from the instrument without damaging the marks;
- permit the easy application of the marks without changing the metrological qualities of the instrument; and
- be visible when the instrument is in service.

3.9.2 Mounting

Instruments required to bear verification marks shall have a verification mark support located as specified above, which shall ensure the conservation of the marks as follows:

- when the mark is made with a stamp, the support may consist of a strip of lead or any other material with similar qualities inserted into a plate fixed to the instrument or a cavity bored into the instrument; or
- when the mark consists of an adhesive transfer, a space shall be provided for this purpose.

4 Requirements for electronic instruments

Electronic instruments shall comply with the following requirements, in addition to the applicable requirements of all other clauses.

4.1 General requirements

4.1.1 Rated operating conditions

Electronic weighing instruments shall be designed and manufactured so that they do not exceed the maximum permissible errors under rated operating conditions.

4.1.2 Disturbances

Electronic weighing instruments shall be designed and manufactured so that when they are exposed to disturbances, either:

a) significant faults do not occur; or

b) significant faults are detected and acted upon.

Note: A fault equal to or less than the value specified in T.4.2.5 (1 *d*) is allowed irrespective of the value of the error of indication.

4.1.3 Durability

The requirements in 4.1.1 and 4.1.2 shall be met durably in accordance with the intended use of the instrument.

4.1.4 Evaluation for compliance

A type of an electronic weighing instrument is presumed to comply with the requirements in 4.1.1, 4.1.2 and 4.1.3 if it passes the examination and tests specified in Annex A.

4.2 Application

The requirements in 4.1.2 may be applied separately to the following:

a) each individual cause of significant fault, and/or

b) each part of the electronic instrument.

The choice of whether 4.1.2 a) or b) is applied is left to the manufacturer.

4.3 Functional requirements

4.3.1 Acting upon a significant fault

When a significant fault has been detected, the instrument shall either be made in-operative automatically, or a visual or audible indication shall be provided and shall continue until the user takes action or the fault disappears.

4.3.2 Switch-on procedure

If the failure of an indicator display element can cause a false weight indication then the instrument shall have a display test facility which is automatically initiated at switch-on (in the case of electronic instruments permanently connected to the mains at switch-on of indication), e.g. indication of all the relevant signs of the indicator in their active and non-active states for a sufficient time to be easily observed by the operator.

4.3.3 Influence factors

An electronic weighing instrument shall comply with the requirements of 2.7, and in addition it shall maintain its metrological and technical characteristics at a relative humidity of 85 % at the upper limit of the temperature range of the instrument.

4.3.4 Disturbances

When an electronic weighing instrument is subjected to the disturbances specified in Annex A, either of the following shall apply:

a) the difference between the weight indication due to the disturbance and the indication without the disturbance (intrinsic error) shall not exceed the value specified in T.4.2.5 (1 *d*); or

b) the instrument shall detect and act upon a significant fault.

4.3.5 Warm-up time

During the warm-up time of an electronic weighing instrument, there shall be no indication or transmission of the weighing result and automatic operation shall be inhibited.

4.3.6 Interface

An instrument may be equipped with an interface permitting the coupling of the instrument to external equipment. When an interface is used, the instrument shall continue to function correctly and its metrological functions shall not be influenced.

4.3.7 Battery power supply (DC)

An instrument that operates from a battery power supply shall, whenever the voltage drops below the manufacturer's specified minimum value, either continue to function correctly or automatically be put out of service.

4.4 Examination and tests

The examination and testing of an electronic weighing instrument is intended to verify compliance with the applicable requirements of this Recommendation and especially the requirements in clause 4.

4.4.1 Examination

An electronic weighing instrument shall be examined to obtain a general appraisal of its design and construction.

4.4.2 Performance tests

An electronic weighing instrument or electronic device, as appropriate, shall be tested as specified in Annex A to determine its correct functioning.

Tests are to be conducted on the whole instrument except when the size and/or configuration of the instrument does not lend itself to testing as a unit. In such cases, each separate electronic device shall be subjected to testing, though it is not intended that electronic devices be further dismantled for separate testing of components. In addition, an examination shall be carried out on the fully operational weighing instrument or, if necessary, on the electronic devices in a simulated set-up that sufficiently represents the weighing instrument. The equipment shall continue to function correctly as specified in Annex A.

4.4.3 Span stability testing

The instrument shall be subjected to span stability tests at various intervals before, during and after being subjected to performance tests.

When an instrument is subjected to the span stability test specified in A.8:

- the maximum allowable variation in the errors of indication shall not exceed half the absolute value of the maximum permissible error in 2.2.2 for initial verification for the test load applied on any of the n measurements.
- where the differences of the results indicate a trend more than half the allowable variation specified above, the test shall be continued until the trend comes to rest or reverses itself, or until the error exceeds the maximum allowable variation.

5 Metrological controls

The metrological controls of instruments shall, in agreement with national legislation, consist of the following:

- type evaluation;
- initial verification;

- subsequent verification; and
- in-service inspection.

Tests should be applied uniformly by the legal metrology services and should form a uniform program. Guidance for the conduct of type evaluation and initial verification is provided in OIML International Documents D 19 and D 20 respectively.

5.1 Type evaluation

5.1.1 Documentation

The application for type evaluation shall include documentation which provides the following information for the instrument:

- metrological characteristics;
- a standard set of specifications;
- a functional description of the components and devices;
- drawings, diagrams and general software information (if applicable), explaining its construction and operation; and
- any document or other evidence demonstrating that its design and construction complies with the requirements of this Recommendation.

5.1.2 General requirements

Type evaluation shall be carried out on at least one and, normally, not more than three instruments that represent the definitive type. At least one of the instruments shall be completely installed at a typical site and at least one of the instruments or the major component of an instrument shall be submitted in a form suitable for simulation testing in a laboratory. The evaluation shall consist of the tests specified in 5.1.3.

5.1.3 Type evaluation

The submitted documents shall be examined and tests carried out to verify that the instruments comply with:

a) the metrological requirements in clause 2, particularly with reference to maximum permissible errors when using the range of vehicles (6.4) and operating conditions specified by the manufacturer;

b) the technical requirements in clause 3 including the requirement for security of operation in 3.2; and

c) the requirements for electronic instruments in clause 4.

The appropriate metrological authority:

- shall conduct the tests in a manner which prevents unnecessary commitment of resources;
- shall permit the results of these tests to be assessed for initial verification when the same instrument is involved; and
- shall ensure that an instrument that can be operated as a nonautomatic weighing instrument, meeting the relevant requirements of OIML R 76-1 for class III or class IIII instruments.

Note: The appropriate metrological authority is advised to accept, with the consent of the applicant, test data obtained from other metrological authorities without repeating the tests.

5.1.3.1 In-motion tests

A complete instrument shall be tested:

- in accordance with the test methods in clause 6, using the range of reference vehicles specified in 6.4.
- under the rated operating conditions in accordance with the type specification.

The error for automatic weighing shall be the indicated weight observed and recorded as defined in 6.7 as appropriate, minus the conventional true value of the mass of the test load as defined in 6.6 as appropriate.

The maximum permissible error shall be as specified in 2.2.1 for initial verification and as appropriate for the class of the instrument.

5.1.3.2 Simulation tests

Influence factors shall be applied during simulation tests in a manner that will reveal an alteration of the weighing result for any weighing process to which the instrument could be applied, in accordance with 2.7 and 4.

5.1.3.2.1 Apportioning of errors

Where it is necessary to separately test parts of an instrument or system, the following requirements apply.

The error limits applicable to a part which is examined separately are equal to a fraction p_i of the maximum permissible errors or the allowed variations of the indication of the complete instrument. The fractions for any part have to be taken for the same accuracy class as for the complete instrument incorporating the part.

The fractions p_i shall satisfy the following equation:

$$p_1^2 + p_2^2 + p_3^2 + ... \leq 1$$

The fraction p_i shall be chosen by the manufacturer of the module and shall be verified by an appropriate test. However, the fraction shall not exceed 0.8 and shall not be less than 0.3, when more than one part contributes to the effect in question.

If the metrological characteristics of the load cell or other major component have been evaluated in accordance with the requirements of OIML R 60 or any other applicable Recommendation, that evaluation shall be used to aid type evaluation if so requested by the applicant.

Note: Since the requirements of this clause apply only to the instrument submitted for type evaluation and not to those subsequently submitted for verification, the means used to determine whether the appropriate maximum permissible error or maximum allowable variation has been exceeded will be decided and mutually agreed upon between the metrological authority and the applicant. Following are examples of these means:

- an adaptation of an indicating device or printer to give greater resolution than that of the scale interval;
- the use of the scale interval for stationary load;
- the use of weights of 1/10 *d* to determine the changeover point; and
- any other means mutually agreed upon.

5.1.4 Provision of means for testing

For the purposes of testing, the applicant may be required to furnish the metrological authority with the test vehicles, material, qualified personnel and a control instrument. The instrument under test may be used as a control instrument provided it complies with the requirements in 6.1.2.

5.1.5 Place of testing

Instruments submitted for type approval may be tested at the following places:

- a site at which all necessary tests can be conducted and agreed upon between the metrological authority and the applicant;
- a laboratory considered appropriate by the metrological authority; or
- any other suitable place mutually agreed upon between the metrological authority and the applicant.

5.2 Initial verification

5.2.1 Tests

Instruments shall be tested to verify that they comply with the requirements in clauses 2 (except 2.7) and 3 for any vehicle(s) and product(s) for which they are intended and when operated under normal conditions of use.

Tests shall be carried out by the appropriate metrological authority, in-situ, in a normal installation. The instrument shall be installed so that an automatic weighing operation will be the same for testing as it is for a transaction.

The appropriate metrological authority shall conduct the tests in a manner that prevents an unnecessary commitment of resources. In appropriate situations and to avoid duplicating tests previously performed on the instrument for type evaluation under 5.1.3, the authority may use the results of observed tests for initial verification.

5.2.1.1 Nonautomatic weighing instruments

When an instrument can be operated as a non-automatic weighing instrument, it shall meet the relevant requirements of OIML R 76-1 for class III or class IIII nonautomatic weighing instruments.

5.2.1.2 In-motion tests

In-motion tests shall be conducted:

- in accordance with the descriptive markings (3.8.2);
- under the rated conditions for which the instrument is intended;
- in accordance with the test methods in clause 6, with the exception that the reference vehicles shall be the types of vehicle(s) and product(s) for which the instrument is intended to weigh.

The error for automatic weighing shall be the indicated weight observed and recorded as defined in 6.7 as appropriate, minus the conventional true value of the mass of the test load as defined in 6.6 as appropriate.

The maximum permissible error shall be as specified in 2.2.1 for initial verification and as appropriate for the class of the instrument.

5.2.2 Provision of means for testing

For the purposes of testing, the applicant may be required to furnish the metrological authority with the

test vehicles, material, qualified personnel and a control instrument. The instrument under test may be used as a control instrument provided it complies with the requirements of 6.1.2.

5.2.3 Place of testing

Initial verification tests shall be conducted entirely at the place of installation, and during testing the instrument shall include all parts which form the assembly as intended for normal use.

5.3 Subsequent metrological control

5.3.1 Subsequent verification

Subsequent verification shall be carried out in accordance with the same provisions as in 5.2 for initial verification.

5.3.2 In-service inspection

In-service inspection shall be carried out in accordance with the same provisions as in 5.2 for initial verification, with the exception that the in-service maximum permissible errors shall be applied.

6 Test methods

6.1 Control instrument

6.1.1 Separate control instrument

A control instrument, capable of being used to determine the conventional true value of the mass of each reference vehicle by full draught weighing when stationary, shall be available for weighing reference vehicles. The control instrument used for testing shall ensure the determination of the conventional true value of the mass of the reference vehicles to an error not greater than:

(a) one-third of the appropriate maximum permissible error for in-motion weighing in 2.2.1 if the control instrument is verified immediately prior to weighing the reference vehicles; or

(b) one-fifth of the appropriate maximum permissible error for in-motion weighing in 2.2.1 if the control instrument is verified at any other time.

6.1.2 Integral control instrument

The instrument being verified may be used as the control instrument, provided that it:

- has an appropriate scale interval, or scale interval for stationary load; and
- complies with the requirements of 3.4 and 6.1.1.

6.2 Static weighing

6.2.1 Multiple load receptors

Each load receptor shall be tested by the static-weighing method both independently and in combination.

6.2.2 Test loads

Errors shall be determined for test loads of:

- zero;
- minimum capacity;
- maximum capacity; and
- at or near a load where the maximum permissible error changes.

6.2.3 Distribution of test load

Except for eccentricity tests, standard weights or masses shall be evenly distributed on the load receptor.

6.2.4 Eccentricity tests

Tests shall be carried out without excessive stacking or overlapping of the load on the load receptor, provided that the conditions are practical and safe.

6.3 Verification standards

6.3.1 Weights

The error of the standard weights or masses used shall not be greater than one-third of the maximum permissible error for the load, as specified in Table 2 for initial verification.

6.3.2 Substitution of standard weights

When testing instruments with Max > 1 t, any other constant load may be used instead of standard weights,

provided that standard weights of at least 1 t or 50 % of Max, whichever is greater, are used. Instead of 50 % of Max, the portion of standard weights may be reduced to:

- 35 % of Max if repeatability error is ≤ 0.3 *d*; or
- 20 % of Max if repeatability error is ≤ 0.2 *d*.

The repeatability error has to be determined with a load of about 50 % of Max which is placed 3 times on the load receptor.

6.4 Reference vehicles

The reference vehicles to be used for testing shall represent the range of vehicles available in the appropriate Member State and for which the instrument is intended. There shall be a minimum of three different reference vehicles. Different axle configurations, tractor/trailer configurations, tractor/trailer linkage systems and suspension systems shall be used, as appropriate.

Where a particular instrument is tested using a limited range of vehicle types (e.g. air suspension systems only), then this should be noted on the type approval certificate.

As an example, a minimum of three vehicles shall be selected from the four listed below:

- two-axle rigid;
- four-axle rigid;
- five/six-axle articulated having a three-axle trailer; and
- two/three-axle vehicle with a two/three-axle draw-bar trailer.

The reference vehicles shall be selected to cover, as far as possible, the weighing range for which the instrument is approved.

6.5 Number of in-motion tests

Each reference vehicle shall undertake at least ten test runs as detailed A.9.3.2.2.

6.6 Conventional true value of the mass of the reference vehicles

The conventional true value of the mass of each reference vehicle, unloaded and loaded, shall be determined using the method detailed in A.9.3.2.1.

6.7 Indicated weight

The weight indication or printout of the vehicle weight following an automatic weighing operation shall be observed and recorded.

Annex A (Mandatory)

Test procedures for automatic instruments for weighing road vehicles in motion

Meaning of symbols

I = Indication
L = Load
ΔL = Additional load to next changeover point
P = $I + \frac{1}{2} d - \Delta L$ = indication prior to rounding
d = Scale interval
E = $P - L$ = error
$E\%$ = $(P - L)/L$ %
mpe = Maximum permissible error
EUT = Equipment Under Test
Max = Maximum capacity
Min = Minimum capacity

A.1 Examination for type evaluation

A.1.1 Documentation (5.1.1)

Review the documentation that is submitted, including necessary photographs, drawings, diagrams, general software information, relevant technical and functional description of main components, devices, etc. to determine if it is adequate and correct. Consider the operational manual.

A.1.2 Comparing construction with documentation (5.1.1)

Examine the various devices of the instrument to ensure compliance with the documentation.

A.1.3 Technical requirements (3)

Examine the instrument for conformity with the technical requirements according to the checklist in the test report format (see OIML R 134-2).

A.1.4 Functional requirements (4.3 and 4.4)

Examine the instrument for conformity with the functional requirements according to the checklist given in the test report format.

A.2 Examination for initial verification

A.2.1 Comparing construction with documentation

Examine the instrument for conformity with the approved type.

A.2.2 Descriptive markings (3.8)

Check the descriptive markings according to the checklist in the test report format.

A.2.3 Verification marks (3.9) and sealing devices (3.7)

Check the arrangement for verification marks and sealing according to the checklist given in the test report format.

A.3 General test requirements

A.3.1 Power supply

Power-up the equipment under test (EUT) for a time period equal to or greater than the warm-up time specified by the manufacturer and maintain the EUT energized for the duration of each test.

A.3.2 Zero-setting

Adjust the EUT as closely as practicable to zero prior to each test, and do not readjust it at any time during the test, except to reset it if a significant fault has been indicated.

Certain tests require the automatic zero-setting and zero-tracking devices to be in operation (or not in operation). Where there is no specific requirement to this effect, the automatic zero-setting and zero-tracking devices may be switched-off. When this is done it shall be mentioned in the test report.

A.3.3 Temperature

The tests shall be performed at a steady ambient temperature, usually normal room temperature unless otherwise specified. The temperature is deemed to be steady when the difference between the extreme temperatures noted during the test does not exceed one-fifth of the temperature range of the instrument without being greater than 5 °C and the rate of change does not exceed 5 °C per hour. Note that this requirement does not apply to in-motion weighing tests.

The handling of the instrument shall be such that no condensation of water occurs on the instrument.

A.3.4 Indication with a scale interval smaller than *d*

If an instrument has a device for displaying the indication with a smaller scale interval than d (e.g. $\leq 0.2\ d$), this device may be used to calculate the error. If such a device is used, it shall be noted in the test report.

A.3.5 Control instrument and test standards

A.3.5.1 Control instrument (6.1)

A control instrument meeting the requirements of 6.1 shall be used for weighing the vehicles. Where necessary, standard weights may be used to assess the rounding error.

A.3.5.2 Use of standard weights to assess rounding error

A.3.5.2.1 General method to assess error prior to rounding

For instruments with digital indication having a scale interval d, changeover points may be used to interpolate between scale intervals, i.e. to determine the indication of the instrument, prior to rounding, as follows:

At a certain load, L, the indicated value, I, is noted. Additional weights of say 0.1 d are successively added until the indication of the instrument is increased unambiguously by one scale interval ($I + d$). The additional load ΔL added to the load receptor gives the indication, P, prior to rounding by using the following formula:

$$P = I + 0.5\ d - \Delta L$$

The error prior to rounding is:

$$E = P - L = I + 0.5\ d - \Delta L - L$$

Example: an instrument with a scale interval, d, of 10 kg is loaded with 1000 kg and thereby indicates 1000 kg. After adding successive weights of 1 kg, the indication changes from 1000 kg to 1010 kg at an additional load of 3 kg. Inserted in the above formula these observations give:

$$P = (1000 + 5 - 3)\ \text{kg} = 1002\ \text{kg}$$

Thus the true indication prior to rounding is 1002 kg, and the error is:

$$E = (1002 - 1000)\ \text{kg} = 2\ \text{kg}$$

A.3.5.2.2 Correction for error at zero

Evaluate the error at zero load, (E_0) by the method of A.3.5.2.1.

Evaluate the error at load L, (E) by the method of A.3.5.2.1.

The corrected error prior to rounding, (E_c) is:

$$E_c = E - E_0$$

Example: If, for the example in A.3.5.2.1, the error calculated at zero load was:

$$E_0 = +\ 1\ \text{kg},$$

The corrected error is:

$$E_c = +\ 2 - (+\ 1) = +\ 1\ \text{kg}$$

A.4 Test program

A.4.1 Type evaluation (5.1)

A.1, and A.5 to A.9 shall normally be applied for type evaluation.

A.5.2 may be omitted if the instrument is not to be used as the control instrument for in-motion testing.

The tests for A.6 to A.8 shall be performed with static load, and a vehicle movement simulator (switches) may be used if necessary for the calculation of the weighing results.

A.4.2 Initial verification (5.2)

A.2 and A.9 shall be applied for initial verification tests. If the instrument under test is to be used as the control instrument the tests in A.5.2 shall also be applied.

The test in A.9 shall include all dynamic in-motion effects corresponding to normal operation of the instrument.

A.5 Performance tests during type evaluation

A.5.1 Zero-setting (3.3.1)

A.5.1.1 Range of zero-setting

A.5.1.1.1 Semi-automatic zero-setting

This test shall not be carried out during the span stability test.

With the load receptor empty, set the instrument to zero. Place a test load on the load receptor and use the zero-setting device. Continue incrementing the test load until use of the zero-setting device fails to re-zero when activated. The maximum load that can be re-zeroed is the positive portion of the zero-setting range.

To test the negative portion of the zero-setting range, recalibrate the instrument with an additional weight on the load receptor at the zero and max. This additional weight should be greater than the negative zero-setting range. Then remove weights and after each weight is removed, use the zero-setting device. The maximum load that can be removed while the instrument can still be re-zeroed by the zero-setting device, is the negative portion of the zero-setting range. The initial zero-setting range is the sum of positive and negative portions.

Recalibrate the instrument without this additional weight.

A.5.1.1.2 Automatic zero-setting

This test shall not be carried out during the span stability test.

With the load receptor empty, allow the instrument to automatically set zero. Place a test load on the load receptor and allow time for the automatic zero-setting device to function to see if the instrument is re-zeroed automatically. Repeat this procedure until the instrument will not be re-zeroed automatically. The maximum load that can be re-zeroed is the positive portion of the automatic zero-setting range.

To test the negative portion of the zero-setting range, recalibrate the instrument with an additional weight on the load receptor at the zero and max. This additional weight should be greater than the negative zero-setting range. Then remove weights and after each weight is removed, allow time for the automatic zero-setting device to function to see if the instrument is re-zeroed automatically. The maximum load that can be removed while the instrument can still be re-zeroed by the zero-setting device, is the negative portion of the zero-setting range. The initial zero-setting range is the sum of positive and negative portions.

Recalibrate the instrument without this additional weight.

A.5.1.2 Accuracy of zero-setting

A.5.1.2.1 Semi-automatic zero-setting

The accuracy of the zero-setting device is tested by setting the instrument to zero and then determining the additional load at which the indication changes from zero to one scale interval above zero. The error at zero is calculated according to the description in A.3.5.2.1.

A.5.1.2.2 Automatic zero-setting or zero-tracking

The indication is brought outside of the automatic range. Then the additional load at which the indication changes from one scale interval to the next above is determined and the error is calculated according to the description in A.3.5.2.1. It is assumed that the error at zero load would be equal to the error at the load in question.

A.5.2 Nonautomatic tests of the control instrument (3.4)

Note: This subclause is only applicable to instruments which are to be used as control instruments.

A.5.2.1 Zero-setting

A.5.2.1.1 Accuracy of zero-setting (3.4.1)

Determination of the accuracy of zero-setting is carried out as described in A.5.1.2.1 or A.5.1.2.2, as appropriate.

A.5.2.2 Determination of weighing performance

A.5.2.2.1 Preloading

Before the first weighing test, the instrument shall be preloaded once to near Max.

A.5.2.2.2 Static weighing test (6.2.2)

Apply loads from zero up to and including Max, and then remove the loads back to zero. When determining the initial intrinsic error, at least ten different load values are selected, and for other weighing tests at least five are selected. The values of the loads selected shall include Max and Min, and values at or near those at which the maximum permissible error (mpe) changes.

It should be noted that when loading or unloading weights, the load must be respectively increased or decreased in a uniform progression.

The maximum permissible error shall be the appropriate values from 2.2.2 for initial verification.

A.5.2.3 Eccentricity test (3.4.2 and 6.2.4)

Apply a load equal to 1/3 Max in each of the four quarter segments of the load receptor. On an instrument with a load receptor having n points of support with $n > 4$ the fraction $1/(n–1)$ of Max shall applied to each point of support.

The errors shall not exceed the appropriate maximum permissible errors from 2.2.2 for initial verification.

A.5.2.4 Discrimination test (3.4.3)

The following tests are performed with three different loads, e.g. Min, 0.5 Max and Max.

A load plus sufficient substitution material (e.g. 10 times 0.1 d) is placed on the load receptor. The additional material is then successively removed until the indication, I, is decreased unambiguously by one scale interval, $I - d$. Replace substitution material equivalent to 0.1 d and then a load equal to 1.4 d shall be gently placed on the load receptor and the result will be increased by one scale interval above the initial indication, $I + d$.

A.6 Additional functionality

A.6.1 Warm-up time test (4.3.5)

This test is to verify that metrological performance is maintained in the period immediately after switch on. The method is to check that automatic operation is inhibited until a stable indication is obtained and to verify that zero and span errors comply with the requirements during the first 30 minutes of operation.

Other test methods which verify that metrological performance is maintained during the first 30 minutes of operation may be used.

(1) Disconnect the instrument from the power supply for a period of at least 8 hours prior to the test.

(2) Reconnect the instrument and switch on while observing the indicating device.

(3) Verify that it is not possible to initiate automatic weighing or printout until the indication has stabilized or until completion of the warm-up time if it is specified by the manufacturer (4.3.5).

(4) As soon as the indication of the indicating device has stabilized, set the instrument to zero if this is not done automatically.

(5) Determine the error of zero-setting by the method of A.3.5.2.1, and specify this error as E_{0I} (error of initial zero-setting) at first and as E_0 (zero-setting error) when repeating this step.

(6) Apply a load close to Max. Determine the error by the method of A.3.5.2.1 and A.3.5.2.2.

(7) Verify that:
- zero indication error, E_{0I}, is not greater than 0.25 d (3.3.1)
- span error is not greater than the maximum permissible error specified in 2.2.2 for initial verification.

(8) Repeat steps (5) and (6) after 5, 15 and 30 minutes.

(9) After each time interval verify that:
- zero variation ($E_0 - E_{0I}$) is not greater than 0.25 $d \times P_i$,
- span error is not greater than the maximum permissible error specified in 2.2.2 for initial verification.

A.6.2 Agreement between indicating and printing devices (2.6)

If the instrument has more than one indicating device, the indications of the various devices (both indicating and printing) are compared during the test.

A.7 Influence factor and disturbance tests

A.7.1 Test conditions

A.7.1.1 General requirements

Influence factor and disturbance tests are intended to verify that electronic instruments can perform and function as intended in the environment and under the conditions specified. Each test indicates, where appropriate, the reference condition under which the intrinsic error is determined.

It is not possible to apply the influence factors or disturbances to an instrument that is performing an automatic weighing operation. The instrument shall therefore be subjected to the influence factors or disturbances under static conditions or simulated operation as defined herein. The permissible effects of the influence factors or disturbances, under these conditions, are specified for each case.

When the effect of one influence factor is being evaluated, all other factors are to be held relatively constant, at a value close to normal. After each test the instrument shall be allowed to recover sufficiently before the following test.

Where parts of the instrument are examined separately, errors shall be apportioned in accordance with 5.1.3.2.1.

The operational status of the instrument or simulator shall be recorded for each test.

When an instrument is connected in a configuration other than a normal one, the procedure shall be mutually agreed on by the approving authority and the applicant.

A.7.1.2 Simulator requirements

A.7.1.2.1 General

The simulator for influence factor and disturbance tests should include all electronic devices of the weighing system.

A.7.1.2.2 Weight simulator

For practical reasons, the weight simulator may take various forms. For example, it may be a weigh pan or platform scale of approximately 1/1000th of the weighing range of a site installation, or a load cell simulator. Whichever method is adopted, it must be independently calibrated and readable to at least 0.1 *d*.

A.7.1.2.3 Interfaces (4.3.6)

Susceptibility that would result from the use of electronic interfaces to other equipment shall be simulated in the tests. For this purpose it is sufficient to connect 3 m of interface cable terminated to simulate the interface impedance of the other equipment.

A.7.1.2.4 Documentation

Simulators shall be defined in terms of hardware and functionality by reference to the instrument under test, and by any other documentation necessary to ensure reproducible test conditions. This information shall be attached to, or traceable from, the test report.

A.7.2 Influence factor tests (2.7)

Summary of tests

Test	Conditions applied	§
Static temperatures	mpe(*)	A.7.2.1
Temperature effect on no-load indication	mpe	A.7.2.2
Damp heat, steady state	mpe	A.7.2.3
Power voltage variation (AC)	mpe	A.7.2.4

(*) mpe: maximum permissible error

A.7.2.1 Static temperatures (2.7.1.1)

Static temperature tests are carried out according to basic standard IEC Publication 60068-2-1 (1990) and IEC Publication 60068-2-2 (1974), as detailed in the Bibliography [1] and according to Table 5.

Table 5

Environmental phenomena	Test specification	Test set-up
Temperature	Reference of 20 °C	
	Specified high for 2 hours	IEC 60068-2-2
	Specified low for 2 hours	IEC 60068-2-1
	5 °C	IEC 60068-2-1
	Reference of 20 °C	
Refer to Bibliography [1] for background information and specific parts of the IEC test.		

Supplementary information to the IEC test procedures

Object of the test: To verify compliance with the provisions in 2.7.1.1 under conditions of dry heat (non-condensing) and cold. The test A.7.2.2 may be conducted during this test.

Test procedures in brief:

Precondition: 16 hours.

Condition of the EUT: Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Power is to be "on" for the duration of the test. The zero-setting and zero-tracking facilities shall be enabled as for normal operation.

Stabilization: 2 hours at each temperature under "free air" conditions.

Temperature: As specified in 2.7.1.1.

Temperature sequence: Reference temperature of 20 °C;
Specified high temperature;
Specified low temperature;
A temperature of 5 °C;
Reference temperature of 20 °C.

Number of test cycles: At least one cycle.

Weighing test: Adjust the EUT as close to zero indication as practicable prior to the test (if an automatic zero-tracking device is connected, adjust it to a value near zero). The EUT shall not be readjusted at any time during the test.

After stabilization at the reference temperature and again at each specified temperature, apply at least five different test loads or simulated loads and record:

a) date and time;

b) temperature;

c) relative humidity;
d) test load;
e) indications (as applicable);
f) errors; and
g) functional performance.

Maximum allowable variations: All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in Table 2 for initial verification.

A.7.2.2 Temperature effect on no-load indication (2.7.1.2)

No reference to international standards can be given at the present time. This test should therefore be conducted as described below.

The instrument shall be set to zero and then changed to the prescribed highest and lowest temperatures as well as to 5 °C if applicable. After stabilization the error of the zero indication shall be determined. The change in zero indication per 5 °C shall be calculated. The changes of these errors per 5 °C are calculated for any two consecutive temperatures of this test.

This test may be performed together with the temperature test in A.7.2.1. The errors at zero shall then be additionally determined immediately before changing to the next temperature and after the 2 hour period after the instrument has reached stability at this temperature.

Note: Preloading is not allowed before these measurements.

If the instrument is provided with automatic zero-setting or zero-tracking, it shall not be in operation.

Condition of EUT: Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Power is to be "on" for the duration of the test.

A.7.2.3 Damp heat, steady state (4.3.3)

Damp heat, steady state tests are carried out according to basic standard IEC Publication 60068-2-56 (1988) and IEC Publication 60068-3-4 (2001), as detailed in the Bibliography [2] and according to Table 6.

Table 6

Environmental phenomena	Test specification	Test set-up
Damp heat, steady state	Upper limit temperature and relative humidity of 85 % for 48 hours	IEC 60068-2-56
Refer to Bibliography [1] for background information and specific parts of the IEC test.		

Supplementary information to the IEC test procedures:

Object of the test: To verify compliance with the provisions in 4.1.1 under conditions of high humidity and constant temperature.

Precondition: None required.

Condition of the EUT:	Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Power is to be "on" for the duration of the test. Adjust the EUT as close to zero indication as is practicable prior to the test (if an automatic zero-tracking device is connected, adjust it to a value near zero). The EUT shall not be readjusted at any time during the test. The handling of the EUT shall be such that no condensation of water occurs on the EUT.
Stabilization:	3 hours at reference temperature and 50 % relative humidity. 48 hours at the upper limit temperature specified in 2.7.1.1.
Temperature:	Reference temperature of 20 °C and at the upper limit specified in 2.7.1.1.
Relative humidity:	50 % at reference temperature, 85 % at upper limit temperature.
Temperature-humidity sequence:	Reference temperature of 20 °C at 50 % relative humidity, The upper limit temperature at 85 % relative humidity, Reference temperature of 20 °C at 50 % relative humidity.
Number of test cycles:	At least one cycle.
Weighing test and test sequence:	After stabilization of the EUT at reference temperature and 50 % relative humidity, apply at least five different test loads or simulated loads and record: a) date and time; b) temperature; c) relative humidity; d) test load; e) indications (as applicable); f) errors; and g) functional performance. Increase the temperature in the chamber to the upper limit and increase the relative humidity to 85 %. Maintain the EUT at no load for a period of 48 hours. Following the 48 hours, apply the same test loads or simulated loads and record the data as indicated above. Decrease the relative humidity to 50 % and decrease the temperature in the chamber to the reference temperature. After stabilization of the EUT, apply the same test loads or simulated loads and record the data as indicated above. Allow full recovery of the EUT before any other tests are performed.
Maximum allowable variations:	All errors shall be within the maximum permissible errors specified in 2.2.2 for initial verification.

A.7.2.4 Power voltage variation (AC) (2.7.2)

Power voltage variation tests are carried out according to basic standard IEC Publication 61000-4-11(2001), as detailed in Bibliography [7] and according to Table 7.

Table 7

Environmental phenomena	Test specification	Test set-up
Voltage variation	Reference voltage	IEC 61000-4-11
	Reference voltage + 10 %	
	Reference voltage – 15 %	
	Reference voltage	
Reference voltage (rated voltage) shall be as defined at IEC 61000-4-11 section 5, refer to Bibliography [7] for specific parts of the IEC test.		

Supplementary information to the IEC test procedures

Object of the test: To verify compliance with the provisions in 2.7.2 under conditions of voltage variations.

Test procedures in brief:

Precondition: None required.

Condition of the EUT: Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer.

Adjust the EUT as close to zero indication as practicable prior to the test. If it has an automatic zero-setting function then the instrument should be set to zero after applying each level of voltage.

Number of test cycles: At least one cycle.

Weighing test: The EUT shall be tested with a test or simulated load at or near Min and with one test load or simulated load between 50 % and the maximum capacity of the EUT.

Test sequence: Stabilize the power supply at the reference voltage within the defined limits and record:

a) date and time;
b) temperature;
c) relative humidity;
d) power supply voltage;
e) test loads;
f) indications (as applicable);
g) errors; and
h) functional performance.

Repeat the test weighing for each of the voltages defined in IEC 61000-4-11 section 5 (noting the need in certain cases to repeat the test weighing at both ends of the voltage range) and record the indications.

Maximum allowable variations: All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in 2.2.2 for initial verification.

A.7.3 Disturbance tests (4.1.2 and 4.3.4)

Summary of tests

Test	Conditions applied	§
Short time power reduction	sf (*)	A.7.3.1
Bursts	sf	A.7.3.2
Electrostatic discharge	sf	A.7.3.3
Electromagnetic susceptibility	sf	A.7.3.4

(*) sf: value of the significant fault (see T.4.2.5)

A.7.3.1 Voltage dips and short interruptions

Short time power reduction (voltage dips and short interruptions) tests are carried out according to basic standard IEC Publication 61000-4-11(2001) as detailed in Bibliography [8] and according to Table 8.

Table 8

Environmental phenomena	Test specification	Test set-up
Voltage dips and short interruptions	Interruption from reference voltage to zero voltage for one half cycle Interruption from reference voltage to 50 % of reference voltage for two half cycles. These mains voltage interruptions shall be repeated ten times with a time interval of at least 10 seconds.	IEC 61000-4-11
The reference voltage (rated voltage) shall be as defined at IEC 61000-4-11 section 5, refer to bibliography [8] for specific parts of the IEC test.		

Supplementary information to the IEC test procedures:

Object of the test: To verify compliance with the provisions in 4.1.2 under conditions of short time mains voltage interruptions and reductions.

Test procedures in brief:

Precondition: None required.

Condition of the EUT: Normal power supplied and “on” for a time period equal to or greater than the warm-up time specified by the manufacturer.

Adjust the EUT as close to zero indication as practicable prior to the test. Zero-setting functions shall not be in operation. The EUT shall not be readjusted at any time during the test except to reset if a significant fault has been indicated.

Number of test cycles: At least one cycle.

Weighing test and test sequence: The EUT shall be tested with one small test load.

Stabilize all factors at nominal reference conditions. Apply the test load and record:

a) date and time;
b) temperature;
c) power supply voltage;
d) test load;
e) indications;
f) errors; and
g) functional performance.

Interrupt the power supply to zero voltage for a period equal to one half cycle and conduct the test as detailed in IEC 61000-4-11 section 8.2.1. During interruption observe the effect on the EUT and record as appropriate.

Reduce the power supply to 50 % of nominal voltage for a period equal to two half cycles and conduct the test as detailed in IEC 61000-4-11 section 8.2.1. During reductions observe the effect on the EUT and record as appropriate.

Maximum allowable variations: The difference between the weight indication due to the disturbance and the indication without the disturbance either shall not exceed the value given in T.4.2.5, or the EUT shall detect and act upon a significant fault.

A.7.3.2 Electrical fast transients/burst immunity

Electrical fast transients/burst immunity tests are carried out according to basic standard IEC Publication 61000-4-4 (1995), for 2 minutes with a positive polarity and for 2 minutes with a negative polarity, as detailed in Bibliography [6] and according to Tables 9.1, 9.2 and 9.3.

Table 9.1: Ports for signal lines and control lines

Environmental phenomena	Test specification	Test set-up
Fast transient common mode	0.5 kV (peak) 5/50 ns T_1/T_h 5 kHz rep. frequency	IEC 61000-4-4
Note: Applicable only to ports or interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification.		

Table 9.2: Input and output DC power ports

Environmental phenomena	Test specification	Test set-up
Fast transient common mode	1 kV (peak) 5/50 ns T_1/T_h 5 kHz rep. frequency	IEC 61000-4-4
Note: Not applicable to battery operated appliances that cannot be connected to the mains while in use.		

Table 9.3: Input and output AC power ports

Environmental phenomena	Test specification	Test set-up
Fast transient common mode	1 kV (peak) 5/50 ns T_1/T_h 5 kHz rep. frequency	IEC 61000-4-4

A coupling/decoupling network shall be applied for testing AC power ports.

Supplementary information to the IEC test procedures

Object of the test:	To verify compliance with the provisions in 4.1.2 under conditions where fast transients are superimposed on the mains voltage while observing the weight indication for one small test load.
Test procedures in brief:	
Precondition:	None required.
Condition of the EUT:	Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Reset the EUT if a significant fault has been indicated.
Stabilization:	Before any test stabilize the EUT under constant environmental conditions.
Weighing test:	With the single static load in place, record the following with and without the transients: a) date and time, b) temperature, c) test load, d) indications (as applicable).
Maximum allowable variations:	The difference between the weight indication due to the disturbance and the indication without the disturbance either shall not exceed the value given in T.4.2.5 or the instrument shall detect and act upon a significant fault.

A.7.3.3 Electrostatic discharge

Electrostatic discharge tests are carried out according to basic standard IEC Publication 61000-4-2 (2001), as detailed in Bibliography [3], with test signals and conditions as given in Table 10.

Table 10

Environmental phenomena	Test specification	Test set-up
Electrostatic discharge	8 kV air discharge 6 kV contact discharge	IEC 61000-4-2
Note: The 6 kV contact discharge shall be applied to conductive accessible parts. Metallic contacts, e.g. in battery compartments or in socket outlets, are excluded from this requirement.		

Contact discharge is the preferred test method. 20 discharges (10 with positive and 10 with negative polarity) shall be applied on each accessible metal part of the enclosure. The time interval between successive discharges shall be at least 10 seconds. In the case of a non conductive enclosure, discharges shall be applied on the horizontal or vertical coupling planes as specified in IEC 61000-4-2 (2001). Air discharges shall be used where contact discharges cannot be applied. Tests with other (lower) voltages than those given in Table 10 are not required.

Supplementary information to the IEC test procedures:

Object of the test:	To verify compliance with the provisions in 4.1.2 under conditions where electrostatic discharges are applied while observing the weight indication for one small test load.

Test procedures in brief:

Precondition:	None required.
Condition of the EUT:	Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Reset the EUT if a significant fault has been indicated.
Stabilization:	Before any test stabilize the EUT under constant environmental conditions.
Weighing test:	With the single static load in place, record the following with and without electrostatic discharge: a) date and time, b) temperature, c) test load, d) indications (as applicable).
Maximum allowable variations:	The difference between the weight indication due to the disturbance and the indication without the disturbance either shall not exceed the value given in T.4.2.5 or the instrument shall detect and act upon a significant fault.

A.7.3.4 Electromagnetic susceptibility

A.7.3.4.1 Radiated

Radiated, radio-frequency, electromagnetic field immunity tests (radio-frequency electro-magnetic fields 26 MHz to 1000 MHz) are carried out in accordance with IEC 61000-4-3 (2001) as detailed in Bibliography [4] and according to Table 11.

The unmodulated carrier of the test signal is adjusted to the indicated test value. To perform the test, the carrier is in addition modulated as specified.

Table 11 Enclosure port

Environmental phenomena	Test specification	Test set-up
Radio-frequency electromagnetic field, 1 kKz, 80 % AM	26 MHz to 80 MHz(**) 80 MHz to 1 000 MHz(*) 3 V/m (rms)(unmodulated)	IEC 61000-4-3

Supplementary information to the IEC test procedures:

Object of the test:	To verify compliance with the provisions in 4.1.2 under conditions of specified electromagnetic fields applied while observing the weight indication for one small test load.

Test procedures in brief:

Precondition:	None required.

(*) The lastest version of IEC 61000-4-3 only specifies test levels above 80 MHz.
For frequencies in the lower range the test methods for conducted radio frequency disturbances are recommended (A.7.3.4.2).

(**) However, for an EUT not having at least one conducting cable (such as mains supply, signal line or earth connection), which can couple the equipment to the disturbing RF field, the lower limit of the radiated test should be 26 MHz.

Condition of the EUT: Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Reset the EUT if a significant fault has been indicated.

Stabilization: Before any test stabilize the EUT under constant environmental conditions.

Weighing test: With the single static load in place, record the following with and without electromagnetic fields:

a) date and time,
b) temperature,
c) test load,
d) indications (as applicable).

Maximum allowable variations: The difference between the weight indication due to the disturbance and the indication without the disturbance either shall not exceed the value given in T.4.2.5 or the instrument shall detect and act upon a significant fault.

A.7.3.4.2 Conducted

Conducted, radio-frequency, electromagnetic field immunity tests (radio-frequency electro-magnetic fields 150 kHz to 80 MHz) are carried out in accordance with IEC 61000-4-6 (2001) as detailed in Bibliography [5] and according to Table 12.

The unmodulated carrier of the test signal is adjusted to the indicated test value. To perform the test, the carrier is in addition modulated as specified.

Table 12

Environmental phenomena	Test specification	Test set-up
Radio-frequency electromagnetic field, 1 kKz, 80 % AM	150 kHz to 80 MHz 3 V/m (rms)(unmodulated)	IEC 61000-4-6

Coupling and decoupling devices shall be used for appropriate coupling of the disturbing signal (over the entire frequency range, with a defined common-mode impedance at the EUT port) to the various cables connected to the EUT.

Supplementary information to the IEC test procedures:

Object of the test: To verify compliance with the provisions in 4.1.2 under conditions of specified conducted electromagnetic fields while observing the weight indication for one small test load.

Test procedures in brief:

Precondition: None required.

Condition of the EUT: Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Reset the EUT if a significant fault has been indicated.

Stabilization: Before any test, stabilize the EUT under constant environmental conditions.

Weighing test:	With the single static load in place, record the following with and without electromagnetic fields: a) date and time, b) temperature, c) test load, d) indications (as applicable).
Maximum allowable variations:	The difference between the weight indication due to the disturbance and the indication without the disturbance either shall not exceed the value given in T.4.2.5 or the instrument shall detect and act upon a significant fault.

A.7.4 Disturbances on DC voltage powered instruments

Electronic measuring systems supplied with DC voltage shall fulfill the tests in A.7.2 and A.7.3, with the exception of A.7.2.4, A.7.3.1 and A.7.3.2 which are to be replaced by the following provisions.

A.7.4.1 General provision (2.7.3)

For under-voltages or over-voltages all errors shall be within the maximum permissible errors stated in 2.2.2 for initial verification when the instrument is still operating.

The under-voltage or over-voltage is applied for a complete measurement or part of a measurement.

A.7.4.2 Provision applicable to instruments powered by the battery of a vehicle

Tests pulses 1, 2 and 3 of the relevant part of ISO 7637, as detailed in the Bibliography at [9] and [10], are applied at the various severity levels specified in the Standard.

Pulses shall be repeated for as long as necessary to complete the test.

The type approval certificate shall indicate, for each type of pulse, the maximum severity level met by the instrument.

A.8 Span stability test (4.4.3)

Summary of test

Test	Condition applied	§
Span stability	$\frac{1}{2}$ absolute mpe (*)	A.8

(*) mpe: maximum permissible error on initial verification in 2.2.2.

Note: The maximum permissible error for the zero point shall also be taken into consideration.

Object of the test:	To verify compliance with the provisions in 4.4.3 after the EUT has been subjected to the performance tests.
Reference to standard:	No reference to international standards can be given at present time.

Test procedures in brief:	The test consists of observing the variations of the error of the EUT or simulator under sufficiently constant ambient conditions (reasonably constant conditions in a normal laboratory environment) at various intervals: before, during and after the EUT has been subjected to performance tests. The performance tests shall include the temperature test and, if applicable, the damp heat test; an endurance test shall not be included. Other performance tests listed in this Annex may be performed. The EUT shall be disconnected twice from the mains power supply (or battery supply where fitted) for at least 8 hours during the period of the test. The number of disconnections may be increased if so specified by the manufacturer or at the discretion of the approval authority in the absence of any specification. In the conduct of this test, the operating instructions for the instrument as supplied by the manufacturer shall be considered.
Test severity:	Test duration: 28 days or the time period necessary to conduct the performance tests, whichever is less.
Time *(t)* between tests (days):	$0.5 \leq t \leq 10$.
Test load:	Near maximum capacity (Max); the same test load shall be used throughout the test.
Number of tests (*n*):	At least 8, except where the differences of the results indicate a trend more than half the allowable variation specified. In this case, the measurements shall be continued until the trend comes to rest or reverses itself, or until the error exceeds the maximum allowable variation.
Maximum allowable variations:	The variation in the errors of indication shall not exceed half the absolute value of the maximum permissible error in 2.2.2 for initial verification for the test load applied on any of the *n* measurements.
Precondition:	None required.
Test equipment:	Verified mass standards or simulated loads.
Condition of the EUT:	Normal power supplied and “on” for a time period equal to or greater than the warm-up time specified by the manufacturer. The EUT shall be stabilized at sufficiently constant ambient conditions after switch-on for at least five hours, and at least 16 hours after the temperature and damp heat tests have been performed.
Test sequence:	Stabilize all factors at sufficiently constant ambient conditions. Adjust the EUT as close to zero as possible. Automatic zero-tracking shall be made inoperative and any automatic built-in span adjustment device shall be made inoperative. Apply the test load (or simulated load) and determine the error.

After the first measurement immediately repeat zeroing and loading four times to determine the average value of the error. For subsequent measurements perform only one, unless either the result is outside the specified tolerance or the range of the five readings of the initial measurement is more than 0.1 *d*.

Record the following data:

a) date and time;

b) temperature;

c) relative humidity;

d) test load;

e) indication;

f) errors; and

g) changes in test location,

and apply all necessary corrections resulting from variations in temperature, etc. between the various measurements.

Allow full recovery of the EUT before any other tests are performed.

A.9 Procedure for in-motion weighing

A.9.1 General

Note the accuracy class required for vehicle weighing.

Ensure that the desired scale interval and the maximum capacity comply with Table 3. Check that the minimum capacity complies with 2.4.

For initial verification, tests shall be carried out corresponding to the normal site operation of the instrument.

A.9.2 Control instrument

Establish whether or not the instrument is to be used as the control instrument. If it is to be used as the control instrument then it shall comply with 6.1.2 and be tested, using the test methods in 6.2, in accordance with the requirements of A.5.2.

If vehicles have to be moved over some distance from a separate control instrument to the EUT, the conditions must be closely controlled. Differences in weather conditions will cause errors which will not be determinable and so this should be avoided where possible. Consideration shall also be given to the amount of fuel used and any possible effects that this could have on the reference weight(s).

A.9.3 Weighing

A.9.3.1 Static weighing

This test shall only be applied when the instrument has a static weighing mode. Where the instrument has been tested according to the test at A.9.2 then those results may be used.

Apply test loads from zero up to and including Max, then remove the test loads back to zero. Where the size of the load receptor prevents loading to Max the reduced load should be noted. However, where a reduced load is used, it shall be at least 40 % of Max. At least ten different load values shall be selected. The values of the loads selected shall include Max and Min, and values at or near those at which the maximum permissible error (mpe) changes.

It should be noted that when loading or unloading weights the load must be respectively increased or decreased in a uniform progression.

Ensure that the error is recorded at each change in load and calculate the errors according to A.3.5.2. Record the errors and compare them to the limits in 2.2.2 as appropriate for initial verification or in-service inspection.

A.9.3.2 Vehicle weighing

A.9.3.2.1 Weighing of reference vehicles

Select the required number of reference vehicles as in 6.4.

a) The unloaded reference vehicle weights shall be determined:
   - by full draught weighing the unloaded reference vehicles on the control instrument.

b) The loaded reference vehicle weights shall be determined:
   - by loading the unloaded reference vehicles in a) above with standard test loads, or
   - by full draught weighing the loaded reference vehicles on the control instrument.

A.9.3.2.2 In-motion weighing

All weighings shall be started with the vehicle positioned behind the approach apron.

The speed of each vehicle shall be kept as constant as possible during each in-motion weighing test.

At least ten test runs shall be carried out using each reference vehicle, as follows:
- Six test runs shall be made over the center of the load receptor,
- Two test runs shall be made to the left side of the load receptor,
- Two test runs shall be made to the right side of the load receptor.

The test runs shall be carried out over the range of speeds that the instrument is required to be approved for, including near v_{max}, near v_{min} and the typical site operating speed.

Record the weights of the vehicles as they are displayed or printed by the instrument under test, and calculate the errors according to the vehicle reference weights determined in A.9.3.2.1.

Any errors shall not exceed the appropriate maximum permissible errors specified in 2.2.1.

A.9.3.2.3 Test of operating speed interlock

Test runs with one of the reference vehicles shall be made:
- at a speed in excess of the maximum operating speed (v_{max});
- at a speed below the minimum operating speed (v_{min}) (if applicable);
- with a speed variation in excess of the maximum operating speed variation (($v_{max} - v_{min}$)/v_{min}).

The instrument shall detect the above conditions and not indicate or print the vehicle weight (3.5.5).

Annex B (Informative)

Practical instructions for the installation and operation of automatic instruments for weighing road vehicles in motion

B.1 Weigh zone

A weigh zone shall comprise a load receptor with an apron on both ends.

B.2 Apron construction

The aprons shall be constructed with a stable, load bearing foundation made of concrete. The aprons shall extend in advance of and beyond the load receptor with a length sufficient (minimum of 3 m) to provide the road surface characteristics needed to achieve the required level of accuracy for weighing the desired types of vehicles in motion.

B.3 Spilt material

Care shall be taken in the design and operation of the installation to ensure that, as far as possible, a build-up of spilt material on the weigh zone of the instrument either does not occur, or is removed regularly.

B.4 Overhead structures

Load receptors shall not be installed beneath a loading or conveying mechanism from which loose material might fall.

B.5 Tare weighing

The time between tare weighing and gross weighing operations associated with a particular load shall be minimal.

B.6 Notice of speed restrictions

There shall be means to ensure that all drivers of vehicles that cross the load receptor are aware of the minimum and maximum operating speeds at which they can proceed.

Bibliography

[1] IEC Publication 60068-2-1 (1990): Basic environmental testing procedures. Part 2: Tests, Test Ad: Cold, for heat dissipating equipment under test (EUT), with gradual change of temperature.

IEC Publication 60068-2-2 (1974): Basic environmental testing procedures, Part 2: Tests, Test Bd: Dry heat, for heat dissipating equipment under test (EUT) with gradual change of temperature.

IEC Publication 60068-3-1 (1974): Background information, Section 1: Cold and dry heat tests.

[2] IEC Publication 60068-2-56 (1988): Environmental testing, Part 2: Tests, Test Cb: Damp heat, steady state. Primarily for equipment.

IEC Publication 60068-3-4 (2001): Guidance for damp heat tests.

[3] IEC Publication 61000-4-2(2001): Electromagnetic Compatibility (EMC) Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test. Basic EMC Publication.

[4] IEC Publication 61000-4-3(2001): Electromagnetic Compatibility (EMC) Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test.

[5] IEC Publication 61000-4-6(2001): Electromagnetic Compatibility (EMC) Part 4: Testing and measurement techniques - Section 6: Immunity to conducted disturbances, induced by radio-frequency fields.

[6] IEC Publication 61000-4-4(1995): Electromagnetic Compatibility (EMC) Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test. Basic EMC publication.

[7] IEC Publication 61000-4-11(2001): Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques, Section 11. Voltage dips, short interruptions and voltage variations immunity tests. Section 5.2 (Test levels - Voltage variation). Section 8.2.2 (Execution of the test-voltage variation).

[8] IEC Publication 61000-4-11(2001): Electromagnetic compatibility (EMC)

Part 4: Testing and measurement techniques Section 11. Voltage dips, short interruptions and voltage variations immunity tests. Section 5.1 (Test levels- Voltage dips and short interruptions). Section 8.2.1 (Execution of the test-voltage dips and short interruptions).

[9] ISO 7637-1 1st ed. (1990-06-01): Road vehicles - electrical disturbance by conduction and coupling.

Part 1: Passenger cars and light commercial vehicles with nominal 12 V supply voltage - electrical transient conduction along supply lines only.

[10] ISO 7637-2 1st ed. (1990-06-01): Road vehicles - electrical disturbance by conduction and coupling.

Part 2: Commercial vehicles with nominal 24 V supply voltage - electrical transient conduction along supply lines only.

Printed in France

GRANDE IMPRIMERIE DE TROYES