ORGANISATION INTERNATIONALE
DE MÉTROLOGIE LÉGALE

OIML INTERNATIONAL RECOMMENDATION

Continuous totalizing automatic weighing instruments (belt weighers)
Part 1: Metrological and technical requirements - Tests

Instruments de pesage totalisateurs continus à fonctionnement automatique
(peseuses sur bande)
Partie 1: Exigences métrologiques et techniques - Essais

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FOREWORD

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TERMINOLOGY
(terms and definitions)

The terminology used in this Recommendation conforms to the *International Vocabulary of Basic and General Terms in Metrology* (VIM - 1993 edition) and to the *Vocabulary of legal Metrology* (VML - 1978 edition). In addition, for the purposes of this Recommendation, the following definitions apply.

T.1 General definitions

T.1.1 Weighing instrument

A measuring instrument that serves to determine the mass of a load by using the action of gravity.

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

T.1.2 Automatic weighing instrument

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

T.1.3 Continuous totalizing automatic weighing instrument (belt weigher)

An automatic weighing instrument for continuously weighing a bulk product on a conveyor belt, without systematic subdivision of the mass and without interrupting the movement of the conveyor belt.

T.1.4 Electronic instrument

An instrument equipped with electronic devices.

T.1.5 Control method

The method used to determine the mass of the product used as the test load during material tests. This will generally involve the use of a weighing instrument, referred to as the control instrument.

T.2 Classification

T.2.1 Type of load receptor

T.2.1.1 Weigh table

A load receptor that includes only part of a conveyor.

T.2.1.2 Inclusive of conveyor

A load receptor that includes an entire conveyor.

T.2.2 Belt speed control

T.2.2.1 Single speed belt weigher

A belt weigher that is installed with a conveyor belt designed to operate at a single speed, designated in this Recommendation as the nominal speed.

T.2.2.2 Variable speed belt weigher

A belt weigher that is installed with a conveyor belt designed to operate at more than one speed.

T.3 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.3.1 Load receptor

The part of the belt weigher intended to receive the load.

T.3.2 Belt conveyor

The equipment for conveying the product by means of a belt resting on rollers turning about their axis.

T.3.2.1 Carrying rollers

The rollers by means of which the conveyor belt is supported on a fixed frame.

T.3.2.2 Weighing rollers

The rollers by means of which the conveyor belt is supported on the load receptor.

T.3.3 Electronic parts

T.3.3.1 Electronic device

A device employing 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.

Note: An electronic device, as defined above, may be a complete weighing instrument (for example: counter scale) or part of a weighing instrument (for example: printer, indicator).

T.3.3.2 Electronic sub-assembly

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

T.3.3.3 Electronic component

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

T.3.4 Weighing unit

The part of a belt weigher providing information on the mass of the load to be measured.

T.3.5 Displacement transducer

A device on the conveyor providing information either corresponding to the displacement of a defined length of the belt or proportional to the speed of the belt.

T.3.5.1 Displacement sensing device

The part of the displacement transducer that is in permanent contact with the belt or integral with a non-drive pulley.

T.3.6 Totalization device

A device that uses information supplied by the weighing unit and the displacement transducer to do either:

- an addition of partial loads, or
- an integration of the product of the load per unit length and the speed of the belt.

T.3.7 Totalization indicating device

A device that receives information from the totalization device and indicates the mass of the loads conveyed.

T.3.7.1 General totalization indicating device

A device that indicates the overall total of the mass of all the loads conveyed.

T.3.7.2 Partial totalization indicating device

A device that indicates the mass of the loads conveyed over a limited period.

T.3.7.3 Supplementary totalization indicating device

An indicating device with a scale interval greater than that of the general totalization indicating device and intended to indicate the mass of the loads conveyed over a fairly long period of operation.

T.3.8 Ancillary devices

T.3.8.1 Zero-setting device

A device enabling zero totalization to be obtained over a whole number of revolutions of the empty conveyor belt.

T.3.8.1.1 Nonautomatic zero-setting device

A zero-setting device that requires observation and adjustment by the operator.

T.3.8.1.2 Semi-automatic zero-setting device

A zero-setting device that operates automatically following a manual command or indicates the value of the adjustment required.

T.3.8.1.3 Automatic zero-setting device

A zero-setting device that operates automatically without the intervention of the operator after the belt has been operating empty.

T.3.8.2 Printing device

A device for printing in units of mass.

T.3.8.3 Instantaneous load indicating device

A device that indicates the percentage of the maximum capacity (Max) or the mass of the load acting on the weighing unit at a given time.

T.3.8.4 Flowrate indicating device

A device that indicates the instantaneous flowrate either as the mass of the product conveyed in unit time or as a percentage of the maximum flowrate.

T.3.8.5 Operation checking device

A device that enables certain functions of the belt weigher to be checked and that is particularly intended:

- to simulate the effect of a constant load per unit length by means of a weight, chain, or electrical reference signal, or
- to compare two integrations of a load per unit length over equal time intervals, or
- to indicate that the maximum load has been exceeded, or
- to indicate that the flowrate is either above its maximum or below its minimum value, or
- to draw the attention of the user to a fault in the operation of the belt weigher.

T.3.8.6 Flowrate regulating device

A device intended to ensure a programmed flowrate.

T.3.8.7 Pre-selection device

The means used to pre-set a weight value for a totalized load.

T.3.8.8 Displacement simulating device

A device used in simulation tests on the belt weigher without its conveyor and intended to simulate displacement of the belt while moving the displacement transducer.

T.4 Metrological characteristics

T.4.1 Scale intervals

T.4.1.1 Totalization scale interval (d)

The value, expressed in units of mass, of the difference between two consecutive indicated values, for general and partial totalization devices, with the instrument in its normal weighing mode.

T.4.1.2 Scale interval for testing

The value, expressed in units of mass, of the difference between two consecutive indicated values, for general and partial totalization devices, with the instrument in a special mode for testing purposes. Where such a special mode is not available, the scale interval for testing is equal to the totalization scale interval.

T.4.2 Weigh length (L) [*not applicable to belt weighers inclusive of conveyor*]

The distance between the two imaginary lines at the half distance between the axes of the end weighing rollers and the axes of the nearest carrying rollers.

When there is only one weighing roller, the weigh length is equal to half the distance between the axes of the nearest carrying rollers on either side of the weighing roller.

T.4.3 Weighing cycle [*applicable only to belt weighers whose method of operation is by addition*]

The group of operations relating to each addition of information on the load at the end of which the totalization device returns to its initial position or state for the first time.

T.4.4 Maximum capacity (Max)

The maximum instantaneous net load that the weighing unit is intended to weigh on the portion of the conveyor belt representing the weigh length.

T.4.5 Flowrate

T.4.5.1 Maximum flowrate (Q_{max})

The flowrate obtained with the maximum capacity of the weighing unit and the maximum speed of the belt.

T.4.5.2 Minimum flowrate (Q_{min})

The flowrate above which the weighing results comply with the requirements of this Recommendation.

T.4.6 Minimum totalized load (Σ_{min})

The quantity, in units of mass, below which a totalization may be subject to excessive relative errors.

T.4.7 Maximum load per unit length of the belt

The quotient of the maximum capacity of the weighing unit and the weigh length.

T.4.8 Control value

The value, in units of mass, that is indicated by the totalization indicating device when a known additional mass has been simulated or deposited on the load receptor with the empty belt running for a prescribed number of complete revolutions.

T.4.9 Warm-up time

The time between the moment that power is applied to a belt weigher and the moment that the belt weigher is capable of complying with the requirements.

T.5 Errors

T.5.1 Error (of indication)

The value, in units of mass, of the difference between two readings from a totalization indicating device on a belt weigher, minus the (conventional) true value of the mass relating to those readings. [*Adapted from VIM 5.20*].

T.5.2 Intrinsic error

The error of a belt weigher, determined under reference conditions. [*VIM 5.24*].

T.5.3 Initial intrinsic error

The intrinsic error of a belt weigher as determined prior to performance tests and durability evaluations.

T.5.4 Fault

The difference between the error of indication and the intrinsic error of a belt weigher.

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

T.5.5 Significant fault

A fault greater than the absolute value of the appropriate maximum permissible error for influence factor tests for a load equal to the minimum totalized load (Σ_{min}) for the designated class of the belt weigher.

A significant fault does not include:

- faults that result from simultaneous and mutually independent causes in the belt weigher or in its checking facility,
- faults that imply the impossibility of performing any measurement,
- transitory faults that are momentary variations in the indications which cannot be interpreted, memorized or transmitted as a measurement result,
- faults that are so serious they will inevitably be noticed by those interested in the measurement.

T.6 Influences and reference conditions

T.6.1 Influence quantity

A quantity that is not the measurand but that affects the value of the measurand or the indication of the belt weigher. [*Adapted from VIM 2.7*].

T.6.1.1 Influence factor

An influence quantity having a value within the specified rated operating conditions of the belt weigher.

T.6.1.2 Disturbance

An influence quantity having a value within the limits specified in this Recommendation but outside the rated operating conditions of the belt weigher.

T.6.2 Rated operating conditions

The conditions of use, giving the ranges of the measurand and of the influence quantities for which the metrological characteristics are intended to lie within the maximum permissible errors specified in this Recommendation. [*Adapted from VIM 5.5*].

T.6.3 Reference conditions

A set of specified values of influence factors fixed to ensure a valid intercomparison of measurement results. [*Adapted from VIM 5.7*].

T.7 Tests

T.7.1 Material test

A test carried out on a complete belt weigher using the type of material that it is intended to weigh.

T.7.2 Simulation test

A test carried out with standard weights on a test unit consisting of a complete belt weigher without the belt conveyor.

T.7.3 Performance test

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

T.7.4 Durability test

A test to verify whether the EUT is capable of maintaining its performance characteristics over a period of use.

CONTINUOUS TOTALIZING AUTOMATIC WEIGHING INSTRUMENTS (BELT WEIGHERS)

1 General

1.1 Scope

This International Recommendation specifies the metrological and technical requirements for continuous totalizing automatic weighing instruments of the belt conveyor type, hereinafter referred to as “belt weighers”, that are subject to national metrological control.

It is intended to provide standardized requirements and test procedures for evaluating metrological and technical characteristics in a uniform and traceable way.

1.2 Application

This Recommendation applies to:

- belt weighers that determine the mass of a product in bulk by using the action of gravity on that product;
- belt weighers that are intended for use with single speed belt conveyors and belt weighers that are intended for use with variable speed belt conveyors.

1.3 Terminology

The terminology given in pages 4-10 shall be considered as a part of this Recommendation.

2 Metrological requirements

2.1 Accuracy classes

Belt weighers are divided into three accuracy classes as follows:

0.5   1   2

2.2 Maximum permissible errors

Maximum permissible errors apply to loads equal to or greater than the minimum totalized load (Σ_{min}).

2.2.1 Maximum permissible errors for automatic weighing

The maximum permissible errors for each accuracy class, positive or negative, are the appropriate values in Table 1 rounded to the nearest totalization scale interval (d).

Table 1

Class	Percentage of the mass of the totalized load for:	
	Initial verification	In-service
0.5	0.25	0.5
1	0.5	1.0
2	1.0	2.0

2.2.2 Difference between indicated or printed weighing results

For the same load, the difference between weighing results provided by any two devices having the same scale interval shall be zero.

2.2.3 Maximum permissible errors for influence factor tests

The maximum permissible errors for each accuracy class, positive or negative, are the appropriate values in Table 2 rounded to the nearest totalization scale interval (d).

Table 2

Class	Percentage of the mass of the totalized load
0.5	0.18
1	0.35
2	0.70

However, when testing with influence quantities on a load cell or an electronic device comprising an analogue component, the maximum permissible error for the device under test shall be 0.7 times the appropriate value specified in Table 2 above.

2.3 Minimum value of minimum totalized load (Σ_{min})

The minimum totalized load shall be not less than the largest of the following values:

- 2 % of the load totalized in one hour at maximum flowrate;
- the load obtained at maximum flowrate in one revolution of the belt;
- the load corresponding to the appropriate number of totalization scale intervals in Table 3.

Table 3

Class	Totalization scale intervals (d)
0.5	800
1	400
2	200

2.4 Minimum flowrate (Q_{min})

a) Single speed belt weighers

The minimum flowrate shall be equal to 20 % of the maximum flowrate, unless the characteristics of a particular installation are such that the flowrate variation is less than a ratio of 5 to 1, exclusive of the flowrate gradient at the beginning and the end of the conveyance of the bulk load. In this case, the minimum flowrate shall not exceed 35 % of the maximum flowrate.

b) Variable and multi-speed belt weighers

Variable and multi-speed belt weighers may have a minimum flowrate less than 20 % of the maximum flowrate. The minimum instantaneous net load on the weighing unit shall not be less than 20 % of the maximum capacity.

2.5 Simulation tests

2.5.1 Variation of simulation speed

For a variation of ±10 % of each nominal value of the belt speed, or over the range of belt speeds when continuously variable (with the use of a displacement simulation device), the errors shall not exceed the appropriate maximum permissible errors for influence factor tests specified in 2.2.3.

2.5.2 Eccentric loading

The totalization errors for different positions of a load shall not exceed the appropriate maximum permissible errors for influence factor tests specified in 2.2.3.

2.5.3 Zero-setting

Following any zero-setting within the range of the zero-setting device, the totalization error shall not exceed the appropriate maximum permissible error for influence factor tests specified in 2.2.3.

2.5.4 Influence quantities

2.5.4.1 Temperature

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

However for special applications, 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.

2.5.4.2 Temperature effect at zero flowrate

Without intermediate setting to zero, the difference between two totalizations at zero flowrate taken at temperatures differing by 10 °C shall not vary by more than:

- 0.035 % for class 0.5;
- 0.07 % for class 1;
- 0.14 % for class 2

of a load totalized at the maximum flowrate for the duration of the totalization.

The rate of temperature change between the two totalizations shall not exceed 5 °C per hour.

2.5.4.3 Mains power supply (AC)

Belt weighers that are powered by an AC supply shall comply with the appropriate metrological and technical requirements when operated within the following limits (see.4.5.5):

- voltage from –15 % to +10 % of the value marked on the belt weigher, and
- frequency from –2 % to +2 % of the value marked on the belt weigher.

2.5.4.4 Battery power supply (DC)

Belt weighers that are powered by a DC supply shall comply with the appropriate metrological and technical requirements when operated within the specified limits (see 4.5.6).

2.5.5 Metrological characteristics

2.5.5.1 Repeatability

The difference between any two results obtained for the same load placed under the same conditions on the load receptor shall not exceed the absolute value of the appropriate maximum permissible error for influence factor tests specified in 2.2.3.

2.5.5.2 Discrimination of the totalization indicating device

At any flowrate between the minimum and maximum flowrates, the difference between the indications obtained for two totalized loads, differing by a value equal to the maximum permissible error, shall be at least equal to one half of the calculated value corresponding to the difference between these totalized loads.

2.5.5.3 Discrimination of the totalization indicating device used for zero totalization

For tests of a duration of 3 minutes, there shall be a visible difference between the indications obtained at no load and for a load, either deposited on or removed from the load receptor, equal to the following percentages of the maximum capacity:

- 0.05 % for class 0.5;
- 0.1 % for class 1;
- 0.2 % for class 2.

2.5.5.4 Short-term stability of zero

After zero-setting, the difference between the smallest and largest indications obtained in 5 tests, each of 3 minutes duration, must not exceed the following percentages of the load totalized in 1 hour at the maximum flowrate:

- 0.0013 % for class 0.5;
- 0.0025 % for class 1;
- 0.005 % for class 2.

2.5.5.5 Long-term stability of zero

When the short-term stability tests are repeated after 3 hours of operation and without further zero adjustment, the results shall satisfy the requirements in 2.5.5.4, and the difference between the smallest and largest of all indications shall not exceed the following percentages of the load totalized in 1 hour at the maximum flowrate:

- 0.0018 % for class 0.5;
- 0.0035 % for class 1;
- 0.007 % for class 2.

2.6 In-situ tests

2.6.1 Repeatability

The difference between the relative errors for several results obtained at practically identical flowrates, for approximately the same quantities of product and under the same conditions, shall not exceed the absolute value of the appropriate maximum permissible error for automatic weighing in 2.2.1.

2.6.2 Maximum permissible errors on checking of zero

After a whole number of belt revolutions, the variation of the indication at zero shall not exceed the following percentages of the load totalized at the maximum flowrate for the duration of the test:

- 0.05 % for class 0.5;
- 0.1 % for class 1;
- 0.2 % for class 2.

2.6.3 Discrimination of the indicator used for zero-setting

For tests equivalent to a whole number of belt revolutions and of a duration as close as possible to 3 minutes, there must be a visible difference between the indications of the zero indication at no load and for a load either deposited on or removed from the load receptor, equal to the following percentages of the maximum capacity:

- 0.05 % for class 0.5;
- 0.1 % for class 1;
- 0.2 % for class 2.

2.6.4 Maximum variation during zero-load test

During the zero-load test as specified in 2.6.2, the totalization indicator shall not vary from its initial indicated value by more than the following percentages of the load totalized at the maximum flowrate for the duration of the test when the minimum totalized load is equal to or less than 3 belt revolutions at Q_{max}:

- 0.18 % for class 0.5;
- 0.35 % for class 1;
- 0.7 % for class 2.

3 Technical requirements

Preliminary note: At the time of printing this Recommendation, an informative guide is intended to be prepared for separate publication, on recommended belt weigher composition, installation, use and maintenance.

3.1 Suitability for use

A belt weigher shall be designed to suit the method of operation, the materials and the accuracy class for which it is intended.

3.2 Security of operation

3.2.1 Accidental maladjustment

A belt weigher shall be constructed so that a maladjustment likely to disturb its metrological performance cannot normally take place without the effect being obvious.

3.2.2 Operational adjustments

It shall not be possible for the general totalization indicating device to be reset to zero.

It shall not be possible to make operating adjustments or to reset other trade indicating devices during an automatic weighing operation.

3.2.3 Fraudulent use

A belt weigher shall not have characteristics likely to facilitate its fraudulent use.

3.2.4 Operating devices

The operating devices of a belt weigher shall be so designed that it cannot normally come to rest in a position other than that intended, unless all indications and printing procedures are automatically disabled.

3.2.5 Conveyor interlock

If the weighing instrument is switched off or ceases to function, the conveyor belt shall stop, or a visible or audible signal shall be given.

3.2.6 Remote indicating devices

Any remote indicating device which is present shall be provided with an out-of-range indication as specified in 3.4.

3.3 Totalization indicating and printing devices

3.3.1 Quality of indication

Totalization indicating and printing devices shall allow reliable, simple, and non-ambiguous reading of the results by simple juxtaposition and shall bear the name or symbol of the appropriate unit of mass.

3.3.2 Form of the scale interval

The scale intervals of the indicating and 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.

3.3.3 Scale interval (d) of a partial totalization indicating device

The scale interval of a partial totalization indicating device shall be equal to the scale interval of the general totalization indicating device.

3.3.4 Scale interval of a supplementary totalization indicating device

The scale interval of a supplementary totalization indicating device shall be at least equal to 10 times the totalization scale interval.

3.3.5 Range of indication

At least one totalization indicating device on a belt weigher shall be capable of indicating a value equal to the quantity of product weighed in 10 hours of operation at maximum flowrate.

3.3.6 Engagement of totalization indicating devices

Totalization indicating and printing devices shall be permanently engaged.

3.4 Out-of-range indication

A continuous audible or visual indication shall be given when:

- the instantaneous load is above the maximum capacity of the weighing unit, or
- the flowrate is above the maximum or below the minimum value.

3.5 Zero-setting device

The effective mass of the belt shall be balanced by a zero-setting device of a type appropriate to the principle of operation of the belt weigher.

The zero-setting range shall not exceed 4 % of the maximum capacity (Max).

3.5.1 Semi-automatic and automatic zero-setting devices

Semi-automatic and automatic zero-setting devices shall be constructed in such a manner that:

- the setting to zero takes place after a whole number of belt revolutions, and
- the end of the zero-setting operation is indicated, and
- the limits of adjustment are indicated.

It shall be possible to disengage automatic zero-setting devices during testing as appropriate.

A belt weigher may include an automatic zero-setting device only if it is provided with an interlock to prevent zero-setting while it is possible for material to feed onto the belt conveyor.

3.6 Displacement transducer

The displacement transducer shall be designed so that there is no possibility of slip likely to affect the results whether the belt is loaded or not.

Displacement sensing devices shall be driven by the clean side of the belt.

Measurement signals shall correspond with displacements of the belt equal to or less than the weigh length.

It shall be possible to seal adjustable parts.

3.7 Belt weighers inclusive of conveyor

The conveyor shall be constructed in a rigid manner and shall form a rigid assembly.

3.8 Installation conditions

Belt weighers shall only be installed where:

- the frame support of the conveyor is constructed in a rigid manner;
- in any straight longitudinal section, the roller track is such that the belt is constantly supported on the weighing rollers;
- belt cleaning devices, if fitted, are positioned and operated so as to have no significant effect on the results;
- the roller track does not cause slippage of the product.

Belt weighers shall be designed so that the installation of the roller track, the construction and mounting of the belt, and the arrangement of the product feed do not cause excessive additional errors.

3.8.1 Roller track

Belt weighers shall be protected against corrosion and clogging.

The contact surface of the rollers on the load receptor and the track intended to have contact with the same lateral portion of the belt shall be aligned practically in the same plane.

3.8.2 Conveyor belt

The mass per unit length of the belt shall be practically constant. Belt joints shall not have any significant effect on the results.

3.8.3 Speed control

For single speed belt weighers, the speed of the belt during weighing shall not vary by more than 5 % of the nominal speed. For variable speed belt weighers having a speed setting control, the speed of the belt shall not vary by more than 5 % of the set speed.

3.8.4 Weigh length

Belt weighers shall be installed in such a way that the weigh length remains unchanged in service.

If the weigh length can be adjusted, it shall be possible to seal the weigh length adjusting devices.

3.8.5 Belt tension for belt weighers with weigh table

The longitudinal tension in the belt shall be maintained independent of the effects of temperature, wear, or load by a gravity tension unit or some other automatic tensioning device.

Tension shall be such that under normal working conditions, there is practically no slip between the belt and the driving drum.

Where the conveyor length exceeds 10 m, the roller that transfers the force from the tensioner shall have an arc of belt contact of not less than 90°.

3.8.6 Overload protection

Belt weighers shall be protected against the effect of accidental loads greater than the maximum capacity.

3.9 Ancillary devices

Ancillary devices shall not affect the weighing results.

3.10 Sealing

Components that are not intended to be adjusted or removed by the user shall be fitted with a sealing device or shall be encased.

Any casing used shall have a provision for sealing.

3.11 Descriptive markings

Instruments shall bear the following markings.

3.11.1 Markings shown in full

- identification mark of the manufacturer
- identification mark of the importer (if applicable)
- serial number and type designation of the belt weigher
- the inscription: "Zero testing shall have a duration of at least .. revolutions" (*the number of revolutions in zero-setting shall be decided as a consequence of the pattern evaluation*)
- mains voltage ... V
- mains frequency ... Hz

3.11.2 Markings shown in code

- pattern approval sign
- accuracy class 0.5 1 or 2
- totalization scale interval d = ... kg or t
- as appropriate:
  - nominal speed(s) of the belt v = ... m/s, or
  - range of speeds of the belt v = ... / .... m/s
- maximum flowrate Q_{max} = ... kg/h or t/h
- minimum flowrate Q_{min} = ... kg/h or t/h
- minimum totalized load Σ_{min} = ... kg or t

3.11.3 Markings consequential to pattern evaluation

- designation of type(s) of product to be weighed
- maximum capacity (Max) .... kg or t
- weigh length (L) .... m
- control value .... kg or t
- temperature range .... °C / .... °C
- speed range of displacement simulation device .... m/s
- operating frequency (if totalizing by addition) .... cycles/hour
- identification mark on parts of the belt weigher not directly attached to the main unit

3.11.4 Supplementary markings

Depending on the particular use of the belt weigher, supplementary markings may be required on pattern approval by the metrological authority issuing the pattern approval certificate.

3.11.5 Presentation of descriptive markings

Descriptive markings shall be indelible and of a size, shape and clarity to enable legibility under normal conditions of use.

They shall be grouped together in a visible place on the belt weigher, either on a descriptive plate fixed near the general totalization indicating device or on the indicating device itself.

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

3.12 Verification marks

3.12.1 Position

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

- be such that the part on which it is located cannot be removed from the belt weigher without damaging the marks;
- allow easy application of the mark without changing the metrological qualities of the belt weigher;
- be visible without the belt weigher or its protective covers having to be moved when it is in service.

3.12.2 Mounting

Belt weighers required to bear verification marks shall have a verification mark support, at the place provided for above, which shall ensure the conservation of the marks.

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 belt weigher, or into a cavity in the belt weigher.

When the mark consists of an adhesive transfer, a space shall be prepared for this purpose.

4 Requirements for electronic belt weighers

Electronic belt weighers 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

An electronic belt weigher shall be so designed and manufactured that it does not exceed the maximum permissible errors under rated operating conditions.

4.1.2 Disturbances

An electronic instrument shall be designed and manufactured so that when 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 of a significant fault (T.5.5) 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

The pattern of an electronic 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

4.2.1 The requirements in 4.1.2 may be applied separately to:

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

b) each part of the electronic instrument.

4.2.2 The choice as to whether to apply 4.1.2 (a) or (b) is left to the manufacturer.

4.3 Acting upon a significant fault

When a significant fault has been detected, a visual or audible indication shall be provided and shall continue until such time as the user takes action or the fault disappears.

Means shall be provided to retain any totalized load information contained in the instrument when a significant fault occurs.

4.4 Switch-on procedure

Upon switch-on (at switch-on of indication in the case of an electronic belt weigher permanently connected to the mains), a special procedure shall be performed that indicates all the relevant signs of the indicating devices, in their active and nonactive states for a sufficient time to be easily observed by the operator.

4.5 Functional requirements

4.5.1 Influence factors

An electronic belt weigher shall comply with the requirements in 2.5.4 and shall in addition maintain its metrological and technical characteristics at a relative humidity of 85 % at the upper limit of the temperature range of the belt weigher.

4.5.2 Disturbances

When an electronic belt weigher is subjected to a disturbance 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 of a significant fault as specified in T.5.5, or
b) the instrument shall detect and act upon a significant fault.

4.5.3 Warm-up time

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

4.5.4 Interface

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

4.5.5 Mains power supply (AC)

A belt weigher that operates from the mains shall, in the event of a power failure, retain the metrological information contained in the belt weigher at the time of failure for at least 24 hours, and shall be capable of indicating that information for at least 5 minutes during the 24-hour period. A switch-over to an emergency power supply shall not cause a significant fault.

4.5.6 Battery power supply (DC)

A belt weigher 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.

4.6 Examination and tests

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

4.6.1 Examinations

An electronic belt weigher shall be examined to obtain a general appraisal of the design and construction.

4.6.2 Performance tests

An electronic belt weigher or electronic device, as appropriate, shall be tested as defined in Annex A to determine its correct operation.

Tests are to be conducted on the whole belt weigher except when its size and/or configuration does not lend itself to testing as a unit. In such cases, the separate electronic devices shall be subjected to testing. 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 belt weigher or, if necessary for practical reasons, on the electronic devices in a simulated set-up that sufficiently represents the belt weigher. The belt weigher shall continue to function correctly as specified in Annex A.

5 Metrological controls

The metrological controls of belt weighers shall, in agreement with national legislation, consist of:

- pattern evaluation;
- initial verification;
- in-service inspection.

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

5.1 Pattern evaluation

5.1.1 Documentation

The application for pattern evaluation shall include documentation comprising:

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

5.1.2 General requirements

Pattern evaluation shall be carried out on at least one and normally not more than three units that represent the definitive pattern. At least one of the units shall be completely installed at a typical site and at least one of the units shall be submitted in a form suitable for simulation testing of components in a laboratory. The evaluation shall consist of the tests specified in 5.1.3.

5.1.3 Pattern evaluation tests

Belt weighers shall comply with:

- the metrological requirements in clause 2, particularly with reference to maximum permissible errors, using the range and type of products or a specific product indicated by the manufacturer; and
- the technical requirements in clause 3.

Additionally, electronic belt weighers shall comply with the requirements in clause 4.

The appropriate Metrological Authority shall:

- conduct the tests in a manner that prevents an unnecessary commitment of resources;
- permit the results of these tests to be assessed for initial verification.

5.1.3.1 Material tests

In-situ material tests shall be done as follows:

- in accordance with the descriptive markings;
- under the normal conditions of use for which the instrument is intended;
- with a quantity of the product not less than the minimum test load;
- at flowrates between the minimum and maximum values;
- at each belt speed for conveyors with more than one fixed speed, or throughout the speed range for variable speed conveyors;
- in accordance with the test methods in clause 6 and the test procedures in Annex A.

The maximum permissible errors for automatic weighing shall be as specified in 2.2.1, Table 1, for initial verification, as appropriate for the class of the belt weigher.

5.1.3.2 Minimum test load (Σ_t)

The minimum test load shall be the largest of the following values:

- 2 % of the load totalized in one hour at maximum flowrate;
- the load obtained at maximum flowrate in one revolution of the belt (this is not applicable when all material test load readings are obtained over a whole number of belt revolutions);
- the appropriate number of test scale intervals, given in Table 4.

Table 4

Class	Test scale intervals
0.5	800
1	400
2	200

5.1.3.3 Tests for compliance with technical requirements

Tests shall be done where appropriate to assess compliance with the technical requirements in clause 3.

5.1.3.4 Simulation tests

Simulation tests shall be carried out in a manner that will reveal a corruption of the weighing result of any weighing process to which the belt weigher could normally be applied, in accordance with:

- subclause 2.5 for all belt weighers;
- clause 4 for electronic belt weighers.

If the metrological characteristics of the load cell have been evaluated in accordance with the requirements of Recommendation OIML R 60, the evaluation shall be used to aid pattern evaluation of the belt weigher if so requested by the applicant.

Note: The requirements of this subclause only apply to the belt weigher submitted for pattern evaluation and not to those subsequently submitted for verification; the means by which it will be possible to determine whether the appropriate maximum permissible error or maximum allowable variation has been exceeded will be decided mutually between the Metrological Authority and the applicant. For example:

- an adaptation of the totalization indicating device to give greater discrimination than that of the totalization scale interval, or
- use of change point weights, or
- any other means mutually agreed upon.

5.1.4 Provision for means of testing

For the purposes of testing, the applicant may be required to furnish the Metrological Authority with the quantity of product, handling equipment, qualified personnel, and a control instrument.

5.1.5 Place of testing

Belt weighers submitted for pattern approval may be tested at the following places:
- the premises of the Metrological Authority to which the application has been submitted;
- any other suitable place mutually agreed upon between the Metrological Authority and the applicant.

5.2 Initial verification and in-service inspection

5.2.1 Tests

Belt weighers shall comply with the requirements in clause 2, excluding 2.5, and clause 3 for a given product or products for which the belt weigher is intended and when operated under normal conditions of use.

Tests are carried out by the appropriate Metrological Authority, in-situ, with the belt weigher fully assembled and fixed in the position in which it is intended to be used. The installation of a belt weigher shall be designed so that:
- an automatic weighing operation will be virtually the same for testing as it is for a transaction;
- tests can be carried out in a reliable and easy manner without disrupting normal operation.

The appropriate Metrological Authority:
- shall conduct the tests in a manner that prevents an unnecessary commitment of resources;
- may, where appropriate and to avoid duplicating tests previously performed on the belt weigher for pattern evaluation under 5.1.3.1, use the results of observed tests to assess for initial verification at that site.

5.2.1.1 Material tests

In-situ material tests shall be performed:
- in accordance with the descriptive markings;
- under the conditions of use for which the belt weigher is intended;
- with a quantity of product not less than the minimum totalized load;
- at flowrates between the maximum and minimum values;
- at each belt speed for conveyors with more than one fixed speed, or throughout the speed range for variable speed conveyors;
- in accordance with the test methods in clause 6 and the test procedures in Annex A.

Before testing, the conveyor shall operate (preferably loaded) for at least 30 minutes at nominal speed.

A control instrument shall be available at all times in the vicinity of the belt weigher(s) submitted for testing. Storage and transport shall be arranged so as to prevent any loss of the product.

Checking of the mass of the product used may take place before or after its passage over the belt weigher.

The maximum permissible errors for automatic weighing shall be as specified in 2.2.1, Table 1, as appropriate for the class of the belt weigher.

5.2.1.2 Tests for compliance with technical requirements

Tests shall be done to establish compliance of the belt weigher with the technical requirements in clause 3.

5.2.2 Provision of means of testing

For the purposes of testing, the applicant may be required to furnish the Metrological Authority with the quantity of product, handling equipment, and qualified personnel.

6 Test methods

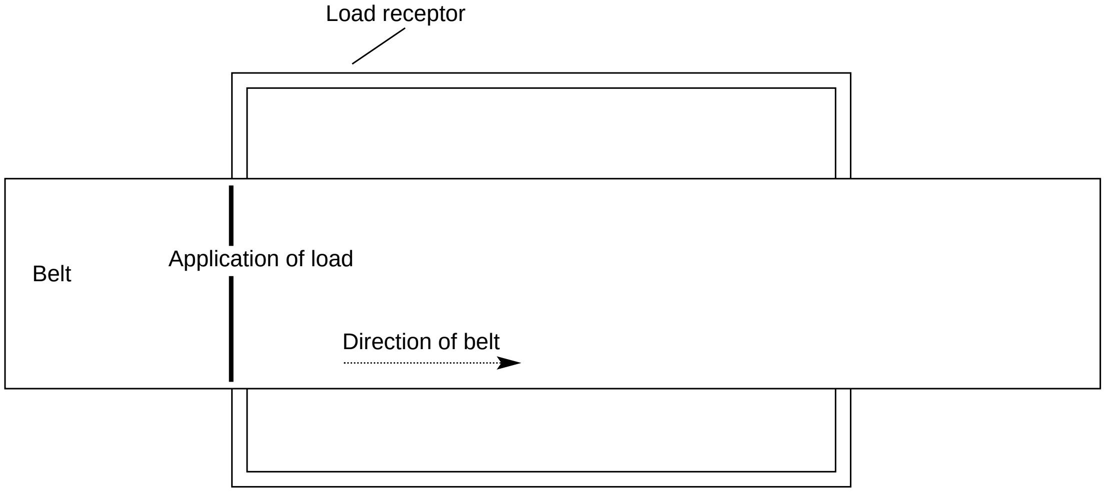
Test methods must comply with the following general principles; detailed procedures are given in Annex A.

6.1 Simulation tests

The test unit for simulation tests shall be fitted with:
- a representative load receptor (normally the complete weigh table);
- a platform (pan) for the standard weights;
- an operation checking device enabling the comparison of integrations with a constant load over equal belt lengths predetermined by the operator and measured by the displacement transducer;
- a displacement simulation device in the case of a test unit without a belt.

The load, which should be distributed along the load receptor in line with the direction of belt travel, is to be placed at various points across the (simulated) belt width.

The duration of each zero totalization shall be equal to the time to weigh the minimum totalized load at minimum flowrate.



6.2 In-situ tests, control method

The control method used for material tests shall enable determination of the weight of the product used for testing with an error not exceeding one-third of the appropriate maximum permissible error for automatic weighing in 2.2.1.

ANNEX A

TEST PROCEDURES
FOR CONTINUOUS TOTALIZING AUTOMATIC WEIGHING INSTRUMENTS
(Mandatory)

Meaning of symbols:

I	=	Indication of the belt weigher
I_n	=	n^{th} indication
S	=	Static load
ΔS	=	Additional static load to next changeover point
T	=	Totalized load (calculated for simulation tests or controlled load for material tests)
L	=	Weigh length
E	=	I – T
E%	=	$\frac{(I - T) \times 100}{T}$ = Error as percentage for simulation tests
mpe	=	Maximum permissible error (absolute value)
EUT	=	Equipment under test
d	=	Totalization scale interval
P	=	I + 0.5 d – ΔS = Indication of the control instrument prior to rounding

Note:

For simulation tests, T is calculated from the simulation test equipment and is the product of the static load S and the pulse count as indicated in the individual tests and test report sheet.

For material tests, T is the indication of the control instrument prior to rounding. Thus (for material tests) T = P.

The calculation of P is only relevant to the control instrument and the subsequent determination of T for material tests.

A.1 Documentation (5.1.1)

Review the documentation that is submitted, including necessary photographs, drawings, relevant technical specifications of main components etc. to determine if it is adequate and correct. Consider the operational manual.

A.2 Comparing construction with documentation

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

A.3 Initial examination

A.3.1 Metrological characteristics

Note metrological characteristics according to the test report format (see OIML R 50-2).

A.3.2 Descriptive markings (3.11)

Check the descriptive markings according to the check-list given in the test report format

A.3.3 Sealing and verification marks (3.10 and 3.12)

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

A.4 General

A.4.1 General requirements for electronic instruments under test (EUT)

This subclause applies only to simulation tests.

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. The deviation of the no-load indication due to any test condition shall be recorded, and any load indication shall be corrected accordingly to obtain the weighing result.

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

A.4.1.1 Indication with a scale interval smaller than d

If an instrument with digital indication has a device for displaying the indication with a smaller scale interval than d, this device may be used to determine the error. The discrimination of the scale interval is to be decided between the applicant and the Metrological Authority. If such a device is used it should be noted in the test report format.

A.4.2 Calculation of error

The relative error is given as (VIM 3.10, 3.12)

$$\text{Relative error} = \frac{(\text{Result of measurement} - \text{Conventional true value}) \times 100\ \%}{\text{Conventional true value}}$$

For the in-situ tests:

$$\text{Relative error} = \frac{(\text{Belt weigher indication} - \text{Control instrument indication}) \times 100\ \%}{\text{Control instrument indication}}$$

For the simulation tests:

$$\text{Relative error} = \frac{(\text{Totalized weight displayed} - \text{Totalized weight calculated}) \times 100\ \%}{\text{Totalized weight calculated}}$$

In the test sheet tables, relative errors shall be expressed as a percentage (%).

If a device with a smaller scale interval than d is not available, the following method may be used to determine the error. When carrying out the simulation tests, allow the simulator to run for a time such that the number of d is equal to 5 times the value in 2.3, Table 3.

Example: class 1 instrument
simulation test mpe 0.35 % (from 2.2.3 Table 2)
Σ_{min} value 400 d (from 2.3 Table 3)
5×400 d = 2 000 d

therefore mpe = 7 d.

The error can therefore be found to 1 d i.e.: 1/7 of mpe.

This is equivalent to a test load of 400 d (Σ_{min} value from Table 3) using test scale of 0.2 d, since
mpe = 1.4 d
1/7 mpe = 0.2 d.

By increasing the test load, the value of d is less significant to the mpe for the test load.

For material tests see A.11.

A.5 Test program

A.5.1 Pattern evaluation

Note: The tests covered in clauses A.7 and A.8 are to be conducted as simulation tests.

All tests in A.6 to A.11 shall normally be applied for pattern evaluation.

A.5.2 Initial verification

Only clauses A.10 *In-situ tests* and A.11 *In-situ material tests*, are normally required for initial verification tests.

A.6 Performance tests during pattern evaluation

A.6.1 General conditions

A.6.1.1 Warm-up time (4.5.3)

Energize the EUT and maintain it energized for the duration of the tests. Check that, for a period of time at least equal to the warm-up time specified by the manufacturer, there is no indication or transmission of the result of weighing, and that automatic operation is inhibited.

A.6.1.2 Warm-up time test

To ensure that the time period prior to a stabilized indication is adequate, the instrument shall be disconnected from the electric power supply for a period of at least 8 hours. The instrument shall then be connected and switched on. As soon as the indication has stabilized the following pairs of tests shall be conducted. (For clarity a pair may be defined as a re-run with the same load and other specified parameters).

Note: The percentage of Max is derived from 2.4 and although nominally 20 %, it may be exceeded in certain cases.

Test A

Set the instrument to zero and carry out a totalization of Σ_{min} with a load on the weigh table to equate to Q_{min} (nominally 20 % of Max) for fixed speed beltweighers or 20 % of Max for variable speed and multi-speed belt weighers at maximum belt speed. Note the totalization and the exact duration of the test (normally a preset number of pulses).

Test B

Immediately carry out a totalization at maximum capacity (Max) for exactly the same duration, and (for variable and multi-speed belt weighers) the same (maximum) speed (or number of pulses) used in Test A. Note the totalization.

Repeat tests A and B above consecutively with a time interval between each pair of tests to obtain not less than 3 pairs of totalizations in a total time as close as possible to 30 minutes.

Calculation of error shall be made according to the method for the simulation test in A.4.2.

The relative error, expressed as a percentage, shall not be greater than the maximum permissible error for the influence factor tests (2.2.3, Table 2) appropriate for the class.

A.6.1.3 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 given instrument without being greater than 5 °C and the rate of change does not exceed 5 °C per hour.

A.6.1.4 Power supply

Instruments using electric power shall normally be connected to the power supply and "on" throughout the tests.

A.6.1.5 Recovery

After each test the instrument shall be allowed to recover sufficiently before the following test.

A.6.2 Automatic zero-setting

During the tests, the effect of the automatic zero-setting device may be switched off by use of the interlock facility (see 3.5.1).

Where necessary the status of the automatic zero-setting is defined in the test description.

A.6.3 Simulation tests (5.1.3.4)

The test unit for simulation tests shall be fitted with:

- a representative load receptor (normally the complete weigh table);
- a platform (pan) for the standard weights;
- an operation checking device enabling the comparison of integrations with a constant load over equal belt lengths predetermined by the operator and measured by the displacement transducer;
- a displacement simulation device in the case of a test unit without a belt.

Attention is drawn to the note in 5.1.3.4 and the need to ensure that the scale interval (d) does not compromise the mpe. This should be a consideration in selecting the value of Σ_{min}. The value for Σ_{min} of 5 times the value in 2.3 Table 3, and the procedure in A.4.2, may be used.

A.6.3.1 Variation of simulation speed (2.5.1)

Run the belt or displacement simulation device and allow to stabilize. Carry out each test over the same integral number of simulated belt revolutions (i.e. the same number of displacement transducer pulses), without zero-setting after changing the speed.

With a simulated test totalization of Σ_{min} or (as indicated in A.4.2) 5 times the value in 2.3 Table 3, and at a flowrate close to Q_{max}, totalize at 90 % of nominal speed. Repeat at 110 % of nominal speed.

For multi-speed belt weighers, carry out one test at each set speed.

For variable-speed belt weighers, carry out totalizations at:

- 90 % and 110 % of minimum speed;
- minimum plus 1/3 of speed range;
- maximum minus 1/3 of speed range, and
- 90 % and 110 % of maximum speed.

If flowrate control is to be used, a further test shall be carried out with the flowrate control in operation. The flowrate set-point is to be stepped down from maximum to minimum in five steps, remaining at each setting for 1 belt revolution.

The errors shall be calculated using the method for simulation tests in A.4.2. Errors shall not exceed the appropriate maximum permissible errors for influence factor tests in 2.2.3, Table 2.

A.6.3.2 Eccentric loading (2.5.2)

For each test, the load is to be distributed along the length of the load receptor in line with the direction of belt travel, and over a half of the simulated belt width.

For a load equivalent to half Max, carry out a separate totalization of a simulated totalized test load of Σ_{min} or (as indicated in A.4.2) 5 times the value in 2.3, Table 3 with the load in each of three bands where:

Band 1 is from the center of the load receptor to one edge of the (simulated) belt,

Band 2 is centered on the center of the load receptor,

Band 3 is as band 1 but on the other side.

The errors shall be calculated using the method for simulation tests in A.4.2 and shall not exceed the appropriate maximum permissible errors for influence factor tests in 2.2.3, Table 2.

A.6.3.3 Zero-setting device (3.5)

With the load receptor empty, set the instrument to zero. Place a test load on the load receptor and operate the zero-setting device. Continue to increment the test load until operation of the zero-setting device fails to re-zero the belt weigher. 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, first re-calibrate the instrument with an additional weight on the load receptor. This additional weight should be greater than the negative zero-setting range. Successively remove the weights, activating the zero-setting device each time one is removed. 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.

Re-calibrate the instrument without this additional weight.

The zero-setting range is the sum of the positive and negative portions and shall not exceed 4 % of Max. If the load receptor cannot readily be re-calibrated, only the positive part of the zero-setting range need be considered.

A.6.3.4 Zero-setting (2.5.3)

Carry out a totalization of Σ_{min} at Q_{max} after setting the belt weigher to zero for loads on the weigh table equivalent to 50 % and 100 % of the positive and negative zero-setting ranges.

The errors shall be calculated using the method for simulation tests in A.4.2 and shall not exceed the appropriate maximum permissible errors for influence factor tests in 2.2.3, Table 2.

The duration of each zero totalization shall be equal to the time required to weigh the minimum totalized load at minimum flowrate.

A.7 Influence factors during pattern evaluation

Summary of tests

Test	Characteristic under test	Conditions applied
A.7.1 Static temperatures	Influence factor	mpe(*)
A.7.2 Temperature effect at zero flowrate test	Influence factor	see A.7.2
A.7.3 Damp heat, steady state	Influence factor	mpe
A.7.4 Mains power supply voltage variation (AC)	Influence factor	mpe
A.7.5 Battery power supply voltage variation (DC)	Influence factor	mpe

(*) mpe: maximum permissible error

A.7.1 Static temperatures (2.5.4.1)

Static temperature tests are carried out according to basic standard IEC Publication 68-2-1 (1990) and IEC Publication 68-2-2 (1974). As detailed in 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 68-2-2
	Specified low for 2 hours	IEC 68-2-1
	5 °C	IEC 68-2-1
	Reference of 20 °C	
Use IEC 68-3-1 (1974) for background information and refer to Bibliography [1] 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 2.5.4.1 under conditions of dry heat (non-condensing) and cold. Test A.7.2 may be conducted during this test.

Test procedures in brief:

Preconditioning:	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 automatic zero-setting should be disabled.
Stabilization:	2 hours at each temperature under “free air” conditions.
Temperature:	As specified in 2.5.4.1.
Temperature sequence:	The reference temperature of 20 °C; The specified high temperature; The specified low temperature; A temperature of 5 °C; The reference temperature of 20 °C.
Number of test cycles:	At least one cycle.
Weighing test:	After stabilization at the reference temperature and again at each specified temperature.
Conduct:	Weighing operation consisting of the totalization of Σ_{min}, two times each at approximately the minimum flowrate, an intermediate flowrate, and the maximum flowrate and repeated again at the minimum flowrate. Record: a) date and time; b) temperature; c) relative humidity; d) test load; e) indications (as applicable); f) errors; g) functional performance.
Maximum allowable variations:	All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in 2.2.3, Table 2.

A.7.2 Temperature effect at zero flowrate test (2.5.4.2)

Test method:	Dry heat (non-condensing) and cold.
Object of the test:	To verify compliance with the provisions in 2.5.4.2 over the operating temperature range.
Reference to standard:	No reference to international standards can be given.

Test procedures in brief:	The test consists of exposure of the EUT to temperatures differing by 10 °C across the entire operating range, under "free air" conditions for a 2 hour period after the EUT has reached temperature stability. At each temperature, the EUT shall be tested during a weighing operation consisting of the totalization over 6 minutes at zero flowrate, using the totalization indicating device for zero-setting. The rate of change of temperature between totalizations shall not exceed 5 °C per hour.
Test severity:	Test duration: 2 hours.
Number of test cycles:	At least one cycle.
Preconditioning:	None.
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 a zero indication as practicable prior to the test. Not to be adjusted or readjusted at any time during the test except to reset the EUT if a significant fault has been indicated. It is important to ensure that the test result is unaffected by the automatic zero-setting function, which should therefore be disabled.
Test sequence:	1. Stabilize the EUT in the chamber at the specified minimum temperature (normally –10 °C). Perform a zero-setting routine. 2. Conduct the test as specified in the test procedures in brief and record the following data: a) date and time; b) temperature; c) relative humidity; d) duration of test; e) totalized indication. 3. Increase the temperature by 10 °C and allow to stabilize. Maintain at that temperature for 2 hours. Repeat the test and record the data as in 2 above. 4. Repeat 3 until the specified maximum temperature is reached (normally +40 °C).
Maximum allowable variations:	The difference between successive totalizations shall not exceed: 0.035 % for class 0.5; 0.07 % for class 1; 0.14 % for class 2 of a load totalized at the maximum flowrate for the duration of the totalization.

A.7.3. Damp heat, steady state (4.5.1)

Damp heat, steady state tests are carried out according to basic standard IEC Publication 68-2-56 (1988) and IEC Publication 68-2-28 (1980). As detailed in 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 2 days (48 hours)	IEC 68-2-56
Use IEC 68-2-28 for guidance for damp heat tests and refer to Bibliography [2] 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 4.5.1 under conditions of high humidity and constant temperature.
Preconditioning:	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. The handling of the EUT shall be such that no condensation of water occurs on the EUT. Adjust the EUT as close to a zero indication as practicable prior to the test. It is important to ensure that the test result is unaffected by the automatic zero-setting function, which should therefore be disabled.
Stabilization:	3 hours at reference temperature and 50 % humidity; 2 days (48 hours) at the upper limit temperature as specified in 2.5.4.1.
Temperature:	Reference temperature of 20 °C and at the upper limit as specified in 2.5.4.1.
Relative humidity:	50 % at reference temperature; 85 % at upper limit temperature.
Temperature-humidity sequence:	The reference temperature of 20 °C at 50 % humidity; The upper limit temperature at 85 % humidity; The reference temperature of 20 °C at 50 % humidity.
Number of test cycles:	At least one cycle.

Weighing test and test sequence: After stabilization of the EUT at reference temperature and 50 % humidity, the EUT shall be tested during a weighing operation consisting of the totalization of Σ_{min}, 2 times each at approximately the minimum flowrate, and the maximum flowrate.

Record:

a) date and time;
b) temperature;
c) relative humidity;
d) test load;
e) indications (as applicable);
f) errors;
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 2 days (48 hours). Following the 2 days, repeat the weighing operation and record the data as indicated above.

Maximum allowable variations: Allow full recovery of the EUT before any other tests are performed. All errors shall be within the maximum permissible errors specified in 2.2.3, Table 2.

A.7.4 Mains power supply voltage variation (AC) (2.5.4.3 and 4.5.5)

Power voltage variation tests are carried out according to basic standard IEC Publication 1000-4-11(1994). As detailed in Bibliography [6] and according to Table 7.

Table 7

Environmental phenomena	Test specification	Test set-up
Voltage variation	Reference voltage	IEC 1000-4-11
	Reference voltage + 10 %	
	Reference voltage – 15 %	
	Reference voltage	
The reference voltage (rated voltage) shall be as defined in IEC 1000-4-11 section 5. Refer to Bibliography [6] 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 2.5.4.3 under conditions of voltage variations.

Test procedures in brief:

Preconditioning: 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 while totalizing Σ_{min} at the maximum flowrate.

Test sequence: Stabilize the power supply at the reference voltage within the defined limits and record the following data while totalizing Σ_{min} at the maximum flowrate:

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

Repeat the test weighing for each of the voltages defined in IEC 1000-4-11 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 2.2.3, Table 2.

A.7.5 Battery power supply voltage variation (DC) (2.5.4.4 and 4.5.6)

Test method: Variation in DC power supply. Where the EUT continues to operate below the stated battery voltage, the following test shall be conducted using an equivalent variable DC power source.

Object of the test: To verify compliance with the provisions in 2.5.4.4 under conditions of varying DC power supply. The requirements shall be met either by use of an equivalent variable DC power source or by allowing the battery voltage to fall by use.

Reference to standard: No reference to international standards can be given.

Test procedures in brief:	The test consists of subjecting the EUT to DC power variations when the former is operating under normal atmospheric conditions, while totalizing Σ_{min} at the maximum flowrate.
Test severity:	Supply voltage: lower limit, the voltage at which the EUT clearly ceases to function (or is automatically put out of service) + 2 % of this voltage.
Number of test cycles:	At least one cycle.
Maximum allowable variations:	All functions shall operate correctly. All indications shall be within the maximum permissible errors specified in 2.2.3, Table 2.

Conduct of the test:	
Preconditioning:	None required.
Test equipment:	Variable DC power source; Calibrated volt meter; Load cell simulator, if applicable.
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 a zero indication as practicable prior to the test. If it has an automatic zero-setting function as part of the automatic weighing process then the instrument should be set to zero after applying each level of voltage.
Test sequence:	Stabilize the power supply at nominal battery voltage ± 2 % and record the following data while totalizing Σ_{min} at the maximum flowrate: a) date and time; b) temperature; c) relative humidity; d) power supply voltage; e) test load; f) indications (as applicable); g) errors; h) functional performance. Reduce the power supply to the EUT until the equipment clearly ceases to function and note the voltage. Switch the EUT "off" and increase the power supply voltage to nominal battery voltage ± 2 %. Switch the EUT "on" and reduce the power supply voltage to the above noted voltage (out of service voltage) + 2 % of the noted voltage. Record the data indicated above while totalizing Σ_{min} at the maximum flowrate.

A.8. Disturbances during pattern evaluation (4.1.2 and 4.5.2)

Summary of tests

Test	Characteristic under test	Conditions applied
A.8.1 Voltage dips and short interruptions	Disturbance	sf (*)
A.8.2 Electrical fast transients/burst immunity	Disturbance	sf
A.8.3 Electrostatic discharge	Disturbance	sf
A.8.4 Electromagnetic susceptibility	Disturbance	sf

(*) sf: value of the significant fault (see T.5.5).

A.8.1 Voltage dips and short interruptions

Short time power reduction (voltage dips and short interruptions) test are carried out according to basic standard IEC Publication 1000-4-11(1994). As detailed in Bibliography [6] 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 1000-4-11
The reference voltage (rated voltage) shall be as defined in IEC 1000-4-11 section 5. Refer to Bibliography [6] 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 while totalizing - at maximum flowrate - at least Σ_{min} (or a time sufficient to complete the test).

Test procedures in brief:

Preconditioning: 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.
Number of test cycles:	At least one cycle.
Weighing test and test sequence:	The EUT shall be tested with while totalizing - at maximum flowrate - at least Σ_{min} (or a time sufficient to complete the test).
	Stabilize all factors at nominal reference conditions. Apply the test load and record the following data: a) date and time; b) temperature; c) relative humidity; d) power supply voltage; e) test load; f) indications (as applicable); g) errors; h) 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 1000-4-11 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 1000-4-11 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 values given in T.5.5, or the EUT shall detect and act upon a significant fault.

A.8.2 Electrical fast transients/burst immunity

Electrical fast transients/burst immunity tests are carried out according to basic standard IEC 1000-4-4 (1995), for 2 minutes with a positive polarity and for 2 minutes with a negative polarity. As detailed in Bibliography [5] 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 1000-4-4
Note: Applicable only to ports or interfacing with cables whose total length may exceed 3 m according to the manufacturers' functional specification.		

Table 9.2: Input and output DC power ports

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 1000-4-4
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	0.5 kV (peak) 5/50 ns T_1/T_h 5 kHz rep. frequency	IEC 1000-4-4

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 totalizing - at maximum flowrate - at least Σ_{min} (or a time sufficient to complete the test).

Test procedures in brief:

Preconditioning: 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 a zero indication as practicable prior to the test.

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

Weighing test: While totalizing - at maximum flowrate - at least Σ_{min} (or a time sufficient to complete the test) record the following with and without the transients:

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

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.5.5 or the instrument shall detect and act upon a significant fault.

A.8.3 Electrostatic discharge

Electrostatic discharge tests are carried out according to basic standard IEC 1000-4-2 (1995), with test signals and conditions as given in Table 10 and as detailed in Bibliography [3].

Table 10

Environmental phenomena	Test specification	Test set-up
Electrostatic discharge	8 kV air discharge 6 kV contact discharge	IEC 1000-4-2
Note: The 6 kV contact discharge shall be applied to accessible conductive 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 1000-4-2 (1995). 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 totalizing - at maximum flowrate - at least Σ_{min} (or for sufficient time to complete the test).
Test procedures in brief:	
Preconditioning:	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:	While totalizing - at maximum flowrate - at least Σ_{min} (or for sufficient time to complete the test), record the following with and without electrostatic discharge: a) date and time; b) temperature; c) relative humidity; d) test load; e) indications (as applicable); f) errors; g) functional performance.

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.5.5 or the instrument shall detect and act upon a significant fault.

A.8.4 Electromagnetic susceptibility

Electromagnetic susceptibility tests (radio frequency electromagnetic fields 26 MHz to 1000 MHz tests) are carried out in accordance to IEC 1000-4-3 (1995). 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 kHz, 80 % AM	26 MHz to 1 000 MHz 3 V/m (rms) (unmodulated)	IEC 1000-4-3

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 totalized load indication (Q_{max} at least Σ_{min}) and the static load S on the weigh table.

Test procedures in brief:

Preconditioning: 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 a zero indication as practicable prior to the test.

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

Weighing test: This test is first conducted with a totalized load indicated (Q_{max} at least Σ_{min}) and the static load S on the weigh table. The data below is recorded and the frequencies are noted at which susceptibility is evident.

Then tests are conducted at the problem frequencies, if any, while totalizing - at maximum flowrate

- at least Σ_{min} (or a time sufficient to complete the test). Record the following with and without electromagnetic fields:

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

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.5.5 or the instrument shall detect and act upon a significant fault.

A.9 Metrological characteristics

A.9.1 Repeatability (2.5.5.1)

1. Apply a distributed load of 20 % Max on the load receptor and carry out a totalization of Σ_{min} or (as indicated in A.4.2) 5 × the value in Table 3. Remove the load, allow the belt weigher to run empty and reset the indication to zero if necessary. Repeat the test with the same load.
2. Repeat the whole test with a load of 50 % Max (Totalization ≈ Σ_{min} or 5 × value in Table 3);
3. Repeat the whole test with a load of 75 % Max (Totalization ≈ Σ_{min} or 5 × value in Table 3);
4. Repeat the whole test with a load of Max (Totalization ≈ Σ_{min} or 5 × value in Table 3).

The difference between any two results obtained for the same load placed under the same conditions on the load receptor shall not exceed the absolute value of the approriate maximum permissible error for influence factor tests specified in 2.2.3.

A.9.2 Discrimination of the totalization indicating device (2.5.5.2)

1. Apply a distributed load of 20 % Max on the load receptor and carry out a totalization of Σ_{min}, noting the exact duration of the test (normally a preset number of pulses). Add additional weights:

   additional load = existing load × 0.18 % for class 0.5;
   additional load = existing load × 0.35 % for class 1;
   additional load = existing load × 0.7 % for class 2,

   and totalize again for the same equivalent belt length.
2. Repeat for a load of 50 % Max.
3. Repeat for a load of 75 % Max.
4. Repeat for a load of Max.

The difference between the indications with and without the additional load shall be at least equal to one half of the calculated value related to the additional load.

A.9.3 Discrimination of the totalization indicating device used for zero totalization (2.5.5.3)

1. Zero the belt weigher and disable any automatic zero-setting device.
2. Totalize with no load for 3 minutes (or the equivalent number of preset pulses) and record the zero indicator reading. If the indicator can be reset to zero, reset it at the end of each 3-minute test. Add a small weight to the load receptor as follows:

   Max × 0.05 % for class 0.5;
   Max × 0.1 % for class 1;
   Max × 0.2 % for class 2.

   Totalize for a further 3 minutes and record the zero indicator reading.
3. Remove the small weight, totalize for 3 minutes (or the equivalent number of preset pulses) and record the zero indicator reading.

Reset the belt weigher to zero with the weight on the load receptor, disable any auto-zeroing device, and repeat the tests in 2 above but with the weight removed from the zero point.

Repeat the test as necessary to eliminate the effect of short term zero drift or other transient effects. The difference between two consecutive indications, with and without the small weight, shall be clearly visible.

A.9.4 Short and long-term stability of zero (2.5.5.4 and 2.5.5.5)

Zero the belt weigher and disable any automatic zero-setting device. Totalization values are to be taken from the indicator used for zero totalization.

Run the belt weigher with no load, record the initial totalization indication, and the reading after each 3-minute interval for a period of 15 minutes. The difference between the smallest and largest indication obtained must not exceed the following percentages of the load totalized in 1 hour at the maximum flowrate:

0.0013 % for class 0.5;
0.0025 % for class 1;
0.005 % for class 2.

Leave the belt weigher running for 3 hours without further adjustment and then record the totalization indication and after each 3-minute interval for a further period of 15 minutes. The results shall satisfy the previous requirements and the difference between the smallest and largest of all indications shall not exceed the following percentages of the load totalized in 1 hour at the maximum flowrate:

0.0018 % for class 0.5;
0.0035 % for class 1;
0.007 % for class 2.

A.10 In-situ tests (2.6.2 to 2.6.4)

Note the repeatability test in 2.6.1 is a material test covered in clause A.11 *In-situ material tests* below.

A.10.1 Maximum permissible errors on checking of zero (2.6.2)

When the minimum totalized load is equal to or less than 3 belt revolutions at Q_{max} the following test procedure shall be amended by the inclusion of the requirements in A.10.3.

Mark the stationary belt if not previously done. The instrument should be "on", warm, and running. Set the instrument to zero noting the point on the belt at which the zero routine commences, and then disable the automatic zero-setting device. Carry out a whole number of revolutions of the empty belt, of a duration as close as possible to 3 minutes. Stop the belt, or if this is impractical stop or note the totalization and check that the error (the variation from zero displayed on the indicating device used for zero-setting) does not exceed the following percentages of the load totalized at Q_{max} for the duration of the test:

0.05 % for class 0.5;
0.1 % for class 1;
0.2 % for class 2.

If the instrument fails, this procedure may be repeated once to attempt to obtain a satisfactory result.

A.10.2 Discrimination of the indicator used for zero-setting (2.6.3)

Mark the stationary belt if not previously done. The instrument should be "on", warm, and running.

Test A

Run the belt and zero the instrument with the automatic zero-setting device disabled. Stop the belt, or if this is impractical, stop or note the totalization.

Run the belt with no load for a whole number of revolutions and of a duration as close as possible to 3 minutes. Record the indication on the indication device used for zero-setting. Stop the belt, or if this is impractical, stop or note the totalization.

Apply the discrimination load to the load receptor and run the belt for the same number of revolutions. Record the indication on the indication device used for zero-setting. Stop the belt, or if this is impractical, stop or note the totalization.

Test B

With the discrimination load applied to the load receptor, run the belt and zero the instrument with the automatic zero-setting device disabled. Stop the belt, or if this is impractical, stop or note the totalization.

Run the belt with the discrimination load applied for the same number of revolutions as in test A. Record the indication on the indication device used for zero-setting. Stop the belt, or if this is impractical, stop or note the totalization.

Remove the discrimination load from the load receptor and run the belt for the same number of revolutions. Record the indication on the indication device used for zero-setting.

There must be a visible difference between the above no-load indication and applied discrimination load indications on the indication device used for zero-setting in both tests A and B.

The discrimination load should be equal to the following percentages of the maximum capacity:

0.05 % for class 0.5;
0.1 % for class 1;
0.2 % for class 2.

Repeat tests A and B above 3 times consecutively.

A.10.3 Maximum variation during zero-load test (2.6.4)

When the minimum totalized load is equal to or less than 3 belt revolutions at Q_{max} the test procedure in A.10.1 *Maximum permissible errors on checking of zero* shall include a record of the totalization indicator reading at the commencement of the test and a record of the maximum and minimum totalization indicator readings seen during the test. The totalization indicator shall not vary from its initial indicated value by more than the following percentages of the load totalized at Q_{max} for the duration of the test:

0.18 % for class 0.5;
0.35 % for class 1;
0.7 % for class 2.

A.11 In-situ material tests (2.6.1, 5.1.3.1, 5.1.3.2 and 5.2.1.1)

Temporary note: Until determined in the next revision of this Recommendation the term "feeding flowrate" shall for clause A.11 of these test procedures mean "The flowrate of material from a previous device onto the conveyor".

A.11.1 General

A.11.1.1 Conditions and product

In-situ material tests shall be carried out under the normal conditions of use of the belt weigher and with the specified product or products which are or will be used. They shall determine:

a) For pattern evaluation: That the maximum permissible errors for automatic weighing are as specified in 5.1.3.1 (and by reference are the mpe stated in 2.2.1, Table 1) and that for "Repeatability" the relative errors are as specified in 2.6.1.
b) For initial verification and in-service inspection: That the maximum permissible errors for automatic weighing are as specified in 5.2.1.1 (and by reference are the mpe stated in 2.2.1, Table 1) as appropriate and that for "Repeatability" the relative errors are as specified in 2.6.1.

All material tests are carried out in pairs to allow assessment of repeatability. (For clarity a pair may be defined as a re-run with the same material load and other specified parameters (as far as practicable)).

Temporary note: Until clarified in the next revision of this Recommendation, the following should be noted in order to avoid confusion:
5.1.3.1 *Pattern evaluation material tests* refers to "a quantity of the product not less than the minimum test load" whereas 5.2.1.1 *Initial verification and in-service inspection material tests* refers to "a quantity of product not less than the minimum totalized load". The latter is defined in 2.3 verbatim as 5.1.3.2, thus making both the same quantity.

For each pair of tests:

a) the quantity of product to be used shall be as specified in 5.1.3.1 or 5.2.1.1 as appropriate;
b) the results shall be obtained at practically identical flowrates (belt speed and feed flow) and for approximately the same quantities of product under the same conditions.

A.11.1.2 Control method

The control method used for material tests shall enable determination of the weight of the product used for testing with an error not exceeding one-third of the appropriate maximum permissible error for automatic weighing in 2.2.1, Table 1.

If the Metrological Authority requires greater resolution of the control instrument it may be appropriate to use change point weights in the following way:

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

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

The error prior to rounding is:

$E = P - S$

Thus $E = (I + 0.5\ d - \Delta S) - S$

Example: an instrument with a scale interval, d, of 1 kg is loaded with 100 kg and thereby indicates 100 kg. After adding successive weights of 0.1 kg, the indication changes from 100 kg to 101 kg at an additional load of 0.3 kg. Inserted in the above formula these observations give:

$$P = (100 + 0.5 - 0.3)\ \text{kg} = 100.2\ \text{kg}$$

Thus the true indication prior to rounding is 100.2 kg and the error is:

$$E = (100.2 - 100)\ \text{kg} = 0.2\ \text{kg}$$

A.11.2 Material tests

A.11.2.1 Single speed belt weigher

Before the tests the conveyor shall operate for at least 30 minutes.

The following tests shall be carried out at the following feeding flowrates:

Before each test check the zero-setting and, if necessary, set the instrument to zero. On completion of each test record the totalization of the test load.

2 pairs of tests at maximum feeding flowrate;

2 pairs of tests at minimum feeding flowrate;

1 pair of test at intermediate feeding flowrate.

To conform with the test data requirements for “Repeatability” the tests that form a pair should be approximately the same totalized load and duration.

When the minimum feeding flowrate is greater than 90 % of the maximum, only 2 pairs of tests shall be carried out, at any available feeding flowrate.

For “Pattern evaluation” for each test the maximum permissible error shall be as specified in 2.2.1 Table 1 for initial verification.

For “Initial verification and in-service inspection” for each test the maximum permissible error shall be as specified in 2.2.1 Table 1, as appropriate for the class of the belt weigher.

For “Repeatability” the difference between the relative errors (calculated as indicated in A.4.2) for each test, of the same feeding flowrate and approximately the same totalized load, shall not exceed the absolute value of the appropriate maximum permissible error for automatic weighing in 2.2.1.

A.11.2.2 Multi-speed belt weigher

For each speed, the tests specified in A.11.2.1 shall be carried out.

A.11.2.3 Variable speed belt weigher

Besides the tests specified in A.11.2.1, three additional single tests shall be carried out at each of the feeding flowrates in A.11.2.1, varying the speed throughout its range during each of them.

BIBLIOGRAPHY

Below are references to Publications of the International Electrotechnical Commission (IEC), where mention is made in some of the tests in Annex A.

[1] IEC Publication 68-2-1 (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 68-2-2 (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 68-3-1 (1974): Background information, Section 1: Cold and dry heat tests.

[2] IEC Publication 68-2-56 (1988): Environmental testing, Part 2: Tests, Test Cb: Damp heat, steady state. Primarily for equipment.

IEC Publication 68-2-28 (1980): Guidance for damp heat tests.

[3] IEC Publication 1000-4-2(1995): Electromagnetic Compatibility (EMC), Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test. Basic EMC publication.

[4] IEC Publication 1000-4-3(1995): Electromagnetic Compatibility (EMC), Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test.

[5] IEC Publication 1000-4-4(1995): Electromagnetic Compatibility (EMC), Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test. Basic EMC publication.

[6] IEC Publication 1000-4-11(1994): 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).

[7] IEC Publication 1000-4-11(1994): 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).

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