

WELMEC Guide 2

**Guide for
Non-automatic Weighing
Instruments (NAWI)
Automatic Weighing Instruments
(AWI)
Multi-dimensional Measuring
Instruments (MDMI)
(Directives 2014/31/EU and 2014/32/EU)**

Version 2023

For information:

This Guide is made available for the Working Group Measuring Instruments (European Commission expert group E01349) for consideration for future referencing on the Europa Website.



WELMEC e.V. is a cooperation between the legal metrology authorities of the Member States of the European Union and EFTA. This document is one of a number of Guides published by WELMEC e.V. to provide guidance to manufacturers of measuring instruments and to notified bodies responsible for conformity assessment of their products. The Guides are purely advisory and do not themselves impose any restrictions or additional technical requirements beyond those contained in relevant EU Directives. Alternative approaches may be acceptable, but the guidance provided in this document represents the considered view of WELMEC e.V as to the best practice to be followed.

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WELMEC Secretariat

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Foreword

This Guide is intended to provide guidance to all those concerned with the application of Directive 2014/31/EU of the European Parliament and of the Council of 26 February 2014 on non-automatic weighing instruments (NAWIs) and the related harmonized standard EN 45501:2015, and Directive 2014/32/EU of the European Parliament and of the Council of 26 February 2014 on measuring instruments (MID) in relation to automatic weighing instruments (AWIs) and multi-dimensional measuring instruments (MDMIs).

This Guide provides a record of the continuing work of WELMEC Working Group 2 in the area of the common application of the Directives themselves. This Guide aligns with the structure (although not the numbering) of the two Directives to aid with the referencing of decisions.

Horizontal issues concerning these Directives are addressed in other WELMEC Guides that have been developed by other Working Groups. In order to keep the interpretations, these horizontal issues are gathered in the Annexes 1 to 3 until they are included in other WELMEC Guides.

This Guide is one of a number of Guides published by WELMEC to provide guidance to manufacturers of measuring instruments and to Notified Bodies responsible for conformity assessment of their products. The Guides are purely advisory and do not themselves impose any restrictions or additional technical requirements beyond those contained in relevant EU Directives. Alternative approaches may be acceptable, but the guidance provided in this document represents the considered view of WELMEC as to the best practice to be followed.

Section A - Decisions of common application for 2014/31/EU (Non-automatic Weighing Instruments Directive)

The following is a list of decisions reached by WELMEC WG2 of common application under Directive 2014/31/EU, in respect of:

- Chapters 1 to 6 (for Articles that are specific to non-automatic weighing instruments only)
- Annex I, Essential Requirements
- Annex III, Inscriptions

1 Chapters 1 to 6

1.1 Article 1, scope

1.1.1 Weighing of liquids used in air conditioning

If a country has legislation which controls the recording of amounts of air conditioning liquid used or discarded, and if this is done by using non-automatic weighing instruments, then these instruments must be controlled.

1.1.2 Classification

Member States are not restricted to a common application in relation to the classification of instruments therefore the class of instrument required or permitted in one Member State may be different from that in another Member State.

For permitted uses the classification may take one of the following forms:

- Any class
- Any class other than Class I
- Any class other than Class III
- Only Class I and II

Other methods of restricting the use of instruments may be imposed by Member States e.g., limiting the maximum

1.1.3 Postal NAWIs

A postal NAWI used by an organisation (e.g., a company) to weigh letters/parcels that are then stamped by that organisation, rather than by a postal service, are not regarded as being used in a 1.2(a) application.

1.2 Article 2, definition

1.2.1 AWI/NAWI; aid to classification

The following interpretation of the definition of a non-automatic weighing instrument (NAWI) or an automatic weighing instrument (AWI) is intended to be used only when doubt exists in applying the definitions contained in Directive 2014/31/EU and the OIML recommendations.

An instrument capable of performing consecutive weighing cycles without any intervention of an operator is always regarded to be an AWI. If an instrument needs the intervention of an operator, it is regarded to be a NAWI only if the operator is required to determine or verify the weighing result.

Determining the weighing result includes any intelligent action of the operator that affects the result, such as deciding when an indication is stable or adjusting the weight of the weighed product.

Verifying the weighing result means making a decision regarding the acceptance of each weighing result on observing the indication. The weighing process allows the operator to take an action which influences the weighing result in the case where the weighing result is not acceptable.

Note: the necessity to give an instruction to start the weighing process or to release a load is not relevant in deciding the category of instrument.

A weight-price labeler where the operator places the item on the load receptor, the instrument determines stability and prints a label automatically, and the operator then takes the label, removes the item and affixes the label, is a NAWI.

A filling instrument where the operator places the container on the weighing instrument, the fill is done automatically, and the weighing instrument then displays the filled weight, allowing the operator to check the weight and remove the container, may be considered a NAWI or an AWI. It is agreed that the applicant can choose, and the Notified Body then applies the appropriate legislation.

An approved NAWI to which one or more robot operators have been added so that no human operator is now involved, is an AWI.

1.2.2 Unmanned (“automated”) weighbridges

An unmanned (“automated”) weighbridge, which includes an Automatic Number Plate Recognition (ANPR) and a traffic light “control” system, may be considered an AWI where it operates in the following mode of operation.

The vehicle is driven onto the weighbridge and the vehicle stops at the red light, the registration is read by the ANPR and is then transmitted to a PC controlling the weighbridge.

When the weight is stable, the weight value is transmitted to the PC and the traffic light changes to green. There is no operator controlling the weighing sequence and the driver has no interaction with the weighing operation, other than to stop the vehicle on the weighbridge and to drive off the weighbridge on completion of the weighing sequence (determined by the PC controlling the weighbridge and the traffic light).

However, the instrument can be considered to be a NAWI if the weighing instrument requires the intervention of an operator (e.g., the driver) during weighing. This could include acceptance, or rejection, of the weighing results based on a primary indication of the weight value.

1.3 Article 13, Conformity assessment procedures

1.3.1 Multiple indicators in a Type Examination Certificate

It is not acceptable for an EU Type Examination Certificate to allow any unnamed indicator having a Test, Part or Evaluation Certificate to be used. It is acceptable for several different indicators (not necessarily related or even from the same manufacturer), each having its own Test, Part or Evaluation Certificate, to be included in one EU Type

Examination Certificate as long as the Type Examination Certificate names the indicators and their Test, Part or Evaluation Certificate numbers.

1.3.2 Disabled buttons

The tare, print, or any other approved function button may be disabled without this possibility being mentioned in the Type Examination Certificate.

1.3.3 Revision of a TEC to include postal NAWIs: need for testing at a Min of 5 e

The TEC for a Class III NAWI, tested and certified with a Min of 20e, can be revised to permit use of the NAWI as a postal scale, with a Min of 5e, without the need for additional metrological testing (during EU type-examination) at a Min of 5e.

1.3.4 Medical weighing instruments

- Indicators as modules in medical weighing instruments

Some NAWIs used for medical purposes have features useful for medical diagnosis that would not be acceptable in industrial NAWIs. These features might not meet the requirements of EN 45501 but may be acceptable for medical weighing if they meet the essential requirements of the NAWI Directive.

These conditions must be put into the examination certificate, only allowing such features for medical purposes

- Tare in medical weighing instruments

With a weighing function built into a bed, there may be a need to modify the tare without removing the patient from the bed, for example when blankets are added or removed, or during dialysis. Although this does not meet the requirements of EN 45501, it is acceptable if it meets the essential requirements of the NAWI Directive and if it is fully described in the type examination certificate.

- Hold function in medical weighing instruments

WG2 concluded that for medical instruments a “hold function” which operates as follows is not correct:

Press “Hold” key, indication freezes, remove weight (for example a baby) put on next weight. The indication remains the same and so on.

WG2 decided that the Hold function shall be disabled after a certain time limit or after removing the weight. The TEC shall describe the function.

1.3.5 Body mass indicators

Body mass indicators are used for medical diagnosis of human patients and, although primarily intended to calculate the Body Mass Index of the patient, measure and display the weight of the patient.

Body Mass Index (BMI) = the weight in kg divided by the square of the height in meters.

If a BMI indicator is used for medical diagnosis and displays and/or prints the weight, then it requires examination under the NAWI Directive. This need for examination cannot be avoided by having a label near the display of weight saying that this weight is not to be used for diagnosis.

A BMI indicator that measures the weight, but does not display or print it, is not regarded as being a weighing instrument and does not require examination under the NAWI Directive, even if it is used for medical diagnosis.

1.3.6 Content of a type examination certificate (NAWI)

In the EU-type examination certificate it should be stated if the requirements of the harmonized standard EN 45501 have been met or not. Where applicable, any deviations from EN 45501 should be described in the EU-type examination certificate.

The EU-type examination certificate shall also contain information regarding special applications of the instrument.

1.4 Article 15, Conformity marking

1.4.1 Information in data plate for instruments used under Art.1.2 b)

WG2 concluded that instruments that are brought on the market on which the conformity assessment have not been completely carried out shall not bear the number of NB for NAWI.

1.5 Article 16, Clause 2

EU Type Approval Certificates issued under Directive 2009/23/EC and that reference the 'Green M' do not need to be revised to refer to the new Directive and/or the 'supplementary metrology marking' specified under Directive 2014/31/EU.

2 Annex I: Essential Requirements

2.1 Preliminary observation

2.1.1 Printing or recording:

The English version of the Directive states that:

“Where an instrument includes or is connected to more than one indicating or printing device used for the applications listed in Article 1 2(a), those devices which repeat the results of the weighing operation and which cannot influence the correct functioning of the instrument shall not be subject to the Essential Requirements if the weighing results are printed or recorded correctly and indelibly by a part of the instrument which meets the Essential Requirements and the results are accessible to both parties concerned by the measurement. However, in the case of instruments used for direct sales to the public, display and printing devices for the vendor and the customer must fulfil the Essential Requirements.”

In this, it is not clear whether the text “...correctly and indelibly by a part of the instrument which meets the Essential Requirements...” refers to “printed or recorded” or just to “recorded”.

It shall be understood to refer to “printed or recorded”, so that either the printing or the recording (or both) must be performed by a part (or parts) which meet the Essential Requirements.

2.1.2 Data storage devices

In many cases the data storage device (DSD), and the connected software for invoicing and other things, are produced by a company other than the scale manufacturer. The NAWI may have been EU-verified and the DSD connected later on.

If the DSD is necessary at initial verification, then verification cannot be done without it. However, if the instrument is verified without the DSD, and the DSD is subsequently added, then the decision on whether this is a “new instrument” comes under national legislation.

2.2 Metrological requirements

2.2.1 Units of mass

In Directive 2014/31/EU Annex 1, paragraph 1, the units of mass shall be the legal units within the meaning of Council Directive 80/181/EEC relating to units of measurement.

Subject to compliance with this condition, the following units are permitted:

- SI units : kg ; µg; mg; g; t;
- other non-SI units: metric carat, if weighing precious stones

Directive 80/181/EEC (as amended) also makes provision for “supplementary indications”, which are defined in Article 3 as “one or more indications of quantity expressed in units of measurement not contained in Chapter I of the Annex accompanying an indication of quantity expressed in a unit contained in that Chapter”. Chapter I contains the SI or metric units.

For supplementary indications in Imperial units on NAWIs which are primarily metric instruments, any method is acceptable, subject to type examination, which:

- meets the requirements of predominance in Directive 80/181/EEC Article 3.4, and
- allows both indications to be seen at the same time.

The reason for the second of these is that Article 3.1 states that the supplementary indication accompanies the metric indication. The supplementary indication could not accompany the metric indication if it replaced, or was in substitution for, the metric indication, even momentarily.

According to Article 3.3 and the last sentence of Article 4 of Directive 80/181/EEC on the approximation of the laws of the member states relating to units of measurement, a member state may require that measuring instruments bear indications of quantity in a single legal unit of measurement and may require the use of legal units on the indicators of measuring instruments.

Attention of manufacturers and notified bodies is drawn to the fact that instruments with supplementary indications in imperial units may be not legally placed on the market and put into service in the member states that have such restrictions in their transposition of the units directive.

Note: It is not possible to renew EU type examination certificates for instruments that have Imperial units as the primary indication as they no longer meet the requirements of Directive 2014/31/EU.

2.2.2 Accuracy classes

2.2.2.1 Scale intervals

A display which shows a permanent indication of the weight to a higher resolution, e.g., 0.1 e, next to the primary weight indication is not permitted. A weighing result in a higher resolution is not considered to be a secondary indication.

2.2.3 Classification

2.2.3.1 More than one mode of operation (e.g. single range, multiple range and multi interval range)

Under 3.3 of Annex 1 of Directive 2014/31/EU, an instrument may contain different modes of operation, for example single range, multiple range and multi-interval, provided that there is no interference between the different modes of operation. The following is an example:

0 to 15 kg x 5 g (single range)	0 to 6 kg x 2 g (multi-interval range)
	6 to 15 kg x 5 g

In this example, selection between the modes only takes place at switch on. The operative range must be clearly identified on the instrument near to, or on, the display.

2.2.3.2 Multi-interval instruments with subtractive tare

For a multi-interval instrument with subtractive tare the requirement in Directive 2014/31/EU, Annex I, para. 9, "Indication shall be impossible above the maximum capacity (Max), increased by 9 e." can be interpreted as Max + 9 eN where "N" is the number of partial weighing ranges

2.2.4 Accuracy

No guidance.

2.2.5 Repeatability and reproducibility

2.2.5.1 Vehicle mounted non-automatic weighing instruments: Waste collection vehicles

With some of these vehicles it is difficult, or impossible, to perform the normal Eccentricity (eccentric loading) test. If necessary, this test should be performed by other means (for example hanging weights) to produce testing having an effect as close as possible to the requirements of EN 45501 Section 3.9.1. It might, or might not, be possible for the Eccentricity test to be performed on two points instead of the usual four, but the Notified Body issuing the Type examination certificate should determine the requirements for both Type examination and verification.

Obviously, the safety of the personnel performing testing is paramount, and the safety requirements of the Machinery Directive are relevant. Directive 2014/31/EU, in Section 8.6 of the Essential Requirements, states that "Instruments shall be designed to permit ready execution of the statutory controls laid down by this Directive". This includes verification.

2.2.5.2 Eccentricity test of weighbridge

If it is possible that a weighbridge might be used to weigh a range of differently sized vehicles (or both vehicles and objects), then eccentricity testing should be performed during verification to EN 45501 and R 76 Sections A.4.7.1 or A.4.7.2 (eccentric load), and also to Section A.4.7.4 (rolling load). However, if it is documented that the

weighbridge will only be used to weigh vehicles of similar size, then the test of Section A.7.4 (rolling load) is considered sufficient.

2.2.6 Sensitivity

No guidance.

2.2.7 Influence quantities and time

2.2.7.1 Gravity zones

The intention of this section of the guide is to describe a procedure on how the gravity value at the place of putting into service can be taken into consideration, see Annex II point 7.1 of Directive 2014/31/EU.

Gravity information for each of the WELMEC countries is given on the WELMEC website: www.welmec.org

- The new gravity concept

A weighing instrument that is sensitive to gravity shall indicate within the MPE after a conformity assessment procedure - whether in one or two stages, carried out either by a Notified Body or the manufacturer himself.

If the conformity assessment procedure, other than a Module B, is carried out at a location other than the intended place of use, the instrument must be finally adjusted to the g value of that place of use.

Alternatively, the instrument may be finally adjusted to the (fictitious) reference value in the center of a specified gravity zone encompassing the intended place of use.

- Specified gravity zone

A gravity zone is defined by the boundaries for both the geographical latitude φ (boundary values φ_1 and φ_2) and the altitude above sea level, a (boundary values a_1 and a_2). The boundary values shall be chosen as integer multiples of 1° (exceptionally $0,5^\circ$ is also allowed) and 100 m, respectively.

Gravity zones may be chosen by the manufacturer such that the differences of gravity acceleration, Δg_φ and Δg_a , between the value of any place of use within that zone and the reference value of gravity, g_R , for that zone, will not result in an absolute value of variation of any indication of the instrument greater than $1/3$ of the mpe on EU verification. The manufacturer will adjust the instrument, using the gravity formula in eq. (2) and one of the appropriate conditions, eq. (1a), (1b) or (1c), such that it respects the mpe on EU verification at any place of use within the chosen zone:

$$n (\Delta g_\varphi + \Delta g_a) / g_R \leq mpe / (3e) \quad (1a)$$

with: $\Delta g_\varphi = 1/2 |g(\varphi_1, a_m) - g(\varphi_2, a_m)|$ max. variation due to a change in φ ²⁾

$a_m = 1/2 (a_1 + a_2)$ mean value of altitude a

$\Delta g_a = 1/2 |g(\varphi_m, a_1) - g(\varphi_m, a_2)|$ maximum variation due to a change in a

¹⁾ Relative deviations of real gravity values from the gravity values calculated with eq. (2) are not taken into account, because they do normally not exceed 5×10^{-5} and can be neglected.

²⁾ In order to be correct even for unusual applications, it is mentioned that if the gravity zone includes the equator ($\varphi = 0^\circ$) the maximum variation due to φ must be calculated from $\Delta g_\varphi = 1/2 [g(\varphi_{max}, a_m) - g(\varphi=0, a_m)]$, with φ_{max} equal to φ_1 or φ_2 whichever is the greater value.

$$\varphi_m = 1/2 (\varphi_1 + \varphi_2) \quad \text{mean value of latitude } \varphi$$

$$g_R = g(\varphi_m, a_m) \quad \text{reference value of gravity in the zone}$$

$$n = \text{number of verification scale intervals } e \text{ of the weighing instrument}$$

$$mpe = \text{maximum permissible error on EU verification at } Max, \text{ expressed in } e$$

Condition (1a) is, strictly speaking, valid only for $1000 \leq n \leq 2000$ and $n \geq 3000$ (class III instruments), where $n = Max / e$. In the other cases, condition (1a) has to be modified:

$$500 (\Delta g_\varphi + \Delta g_a) / g_R \leq 0,5e / (3e)$$

$$\Leftrightarrow (\Delta g_\varphi + \Delta g_a) / g_R \leq 1 / 3000 \quad \text{if } 500 \leq n < 1000 \quad (1b)$$

and

$$2000 (\Delta g_\varphi + \Delta g_a) / g_R \leq 1,0e / (3e)$$

$$\Leftrightarrow (\Delta g_\varphi + \Delta g_a) / g_R \leq 1 / 6000 \quad \text{if } 2000 < n < 3000 \quad (1c)$$

The same applies by analogy to the other accuracy classes.

- Reference value

For the calculation of the reference value, g_R , and the maximum variations, Δg_φ

and Δg_a , and for the final adjustment of the weighing instrument, depending on the actual g value at the place of EU verification, the "standardised" gravity formula according to /1/ in combination with the theoretical vertical gradient of gravitational acceleration in free air /2/ is used:

$$\begin{aligned} g &= 9,780\,318 (1 + 0,005\,3024 \sin^2 \varphi - 0,000\,0058 \sin^2 2\varphi) \\ &= -0,000\,003085 a \quad \text{m s}^{-2} \quad (2) \end{aligned}$$

In this formula, the latitude φ must be entered in degrees (°) and the altitude a in meters (m).

- Identification

With an instrument adjusted to a gravity zone, a suitable identification of that zone shall be provided. The identification may be either

(i) the reference value, g_R , of the gravity zone, together with the lower and upper limits of gravity values for the zone, or

(ii) a code designation in the form $\varphi_1 - \varphi_2 \equiv a_1 - a_2$ (alternatively $\varphi_1 - \varphi_2 : a_1 - a_2$) that is used uniformly for all WELMEC member states,

$$\text{e.g. } 49-52 \equiv 0-200 \quad (\text{alternatively } 49-52:0-200),$$

which would indicate that the weighing instrument had been adjusted for a mean g value in the zone between latitudes 49° and 52° and altitudes 0 m to 200 m, the fictitious reference "point" being at the latitude $\varphi_m = 50.5^\circ$ and the altitude $a_m = 100$ m.

Note 1: a_1 may exceptionally be a negative number. In that particular case a code designation of eg. $49-52 \equiv -100-200$ would indicate that the weighing instrument had been adjusted for a mean g value in the zone between latitudes 49° and 52° and altitudes -100 m to +200 m.

Note 2: In addition to the code designation in the form $\varphi_1-\varphi_2\equiv a_1-a_2$

a manufacturer is allowed to present additional qualifying information concerning the place (region) of use (e.g., a defined city or the administrative territory like a department, province, region, etc.) provided that the latter is completely located in the gravity zone specified by the latitude and altitude values φ_1 , φ_2 and a_1 , a_2 , respectively.

The identification may be presented by an inscription or any document accompanying the weighing instrument or be available on the display by a procedure described in the operating manual.

- Requirements for securing of adjustment devices

Existing requirements for securing of adjustment devices apply equally to gravity compensating or correcting devices, including the indication of the gravity information on the display. Details are to be mentioned in the type examination certificate of the weighing instrument.

- Practical Procedure, Example

- Given the following weighing instrument to be EU verified:
Retail scale, Class III, $Max = 15$ kg, $e = d = 5$ g, $n = 3000$, $mpe (Max) = 1.5 e$
- The EU verification shall be carried out in one stage at the manufacturer's works that are assumed to be located in Braunschweig, $\varphi = 52.3^\circ$, $a = 80$ m, the g value for Braunschweig being

$$g(\text{Braunschweig}) = 9.812\,484 \text{ m s}^{-2}$$

calculated with Eq. (2).

- The designated place of use shall be Uppsala in Sweden with $\varphi = 59.9^\circ$

and $a = 150$ m (estimated values using a map).

- The manufacturer chooses the following gravity zone according to the rules mentioned in Section 2.2.7.1, 2nd bullet which comprises the designated place of use:

$$59-61 \equiv 0-500$$

Therefore, the boundary values are $\varphi_1 = 59^\circ$, $\varphi_2 = 61^\circ$, $a_1 = 0$ m, $a_2 = 500$ m.

- With the mean values of geographical latitude and altitude,

$$\begin{aligned}\varphi_m &= 1/2 (\varphi_1 + \varphi_2) \\ &= 60^\circ\end{aligned}$$

$$\begin{aligned}a_m &= 1/2 (a_1 + a_2) \\ &= 250 \text{ m}\end{aligned}$$

and the maximum variations

$$\begin{aligned}\Delta g_\varphi &= 1/2 |g(\varphi_1, a_m) - g(\varphi_2, a_m)| \\ &= 0.000\,785 \text{ m s}^{-2}\end{aligned}$$

$$\begin{aligned}\Delta g_a &= 1/2 |g(\varphi_m, a_1) - g(\varphi_m, a_2)| \\ &= 0.000\,771 \text{ m s}^{-2}\end{aligned}$$

and the reference value

$$\begin{aligned}g_R &= g(\varphi_m, a_m) \\ &= 9.818\,399 \text{ m s}^{-2}\end{aligned}$$

it is confirmed that condition (1a) is met:

$$n (\Delta g_{\phi} + \Delta g_a) / g_R \leq mpe / 3e$$

$$3000 (0.000\ 785 + 0.000\ 771) / 9.818\ 399 \leq 1.5 e / 3 e$$

$$0.48 \leq 0.5$$

- Finally, in the last phase of the EU verification in Braunschweig, the retail scale is adjusted to the calculated reference value g_R .

- References

/1/Bulletin OIML No 94, 1984, 23-25; supplemented by:
Bulletin OIML No 127, 1992, 45

/2/Kohlrausch, F.: Praktische Physik, Band 1, 24. Aufl., Stuttgart: Teubner 1996

2.2.7.2 Automatic self-calibration

The process used by an instrument having an internal calibration weight, to calibrate itself while its load receptor is mechanically disconnected, is not considered to be zero setting, and this mechanism is therefore not considered to be an automatic zero setting device.

2.2.7.3 Weighbridges below 10 °C

Weighing equipment must not be used at temperatures outside its approved temperature range, but it would be possible for an examination to be granted for temperatures lower than 10 °C if supported by the necessary testing.

An alternative acceptable solution is to provide load cell heaters and for the indicator to be positioned inside a heated kiosk, to ensure that all the weighing equipment remains within its approved temperature range.

2.2.7.4 GPS device to adjust calibration

The concept of a vehicle-mounted weighing instrument, using a GPS (Global Positioning System) device and a gravity database to adjust its span are acceptable if the Notified Body concerned is sure that the system is secure.

2.2.7.5 Temperature range

WG2 concluded that an instrument must be tested in the complete temperature range to be declared in conformity with the requirements of the Directive.

Example:

It is not allowed to extend the temperature range of an instrument, which is approved for a temperature range -10 °C ... 40 °C, to -20 °C ... 40 °C based on a test for the temperature range -20 °C ... 20 °C.

2.3 Design and construction

2.3.1 NAWI's installed in ships

- Additional sensors

Specially designed gravity compensated scales may incorporate two load cells. The additional load-cell, if any, shall not necessarily be identical to that of the NAWI. The equipment shall be such that requirements about 'g' variations are fulfilled. The same principle applies for tilt compensation and for acceleration.

- **g-compensation**

Minimum value for g-compensation is $\pm 3 \text{ m/s}^2$ unless the instrument display is blanked out, and the print-out and data transmission is inhibited at a lesser value.

g-test:

- g-test is performed dynamically;
- with test loads near zero, near Max and if the number of scale divisions is higher than 500 e, at a load near but lower than 500 e;
- If no limiting value for g-compensation is specified, g-test should be carried out up to $\pm 3 \text{ m/s}^2$ or, where the instrument display is blanked out at a lower value, g-test should be carried out up to this limited value, and
- g-test shall be performed with a frequency that doesn't exceed 0.3 Hz.

During g-test, accuracy of zero setting and tare setting devices shall be tested.

- **Minimum value for tilt – Tilt test**

Tilt testing should be carried out up to 25 % (15 °) unless the instrument display is blanked out, and the print-out and data transmission is inhibited at a lesser value. When a tilt-sensor is regarded as a module, the pi factor shall be determined at the type examination stage.

Where a sensor (measuring the tilt angle) is used to compensate the effect of tilting on the weighing result, the sensor is regarded as an essential part of the weighing instrument. It should therefore be submitted to the essential tests such as temperature, humidity and EMC, during the examination procedure.

Tilt tests shall be introduced into "standard" tests as follows:

- at each temperature, at each step of humidity test, the equipment shall also be tested to a tilted position; only one direction of tilt is necessary; 3 test loads shall be applied, i.e. near zero, near Max and if the number of scale divisions is higher than 500 e, at a load near but lower than 500 e.
- EMC tests are performed with one tilted position with one load near 500 e, not necessary with a small test load (to optimize tests costs and duration)
- If no limiting value for tilt is specified, tilt-tests should be carried out up to 25 % (15 °) or, where the instrument display is blanked out at a lower value, tilt-tests should be carried out up to this limited value.

Remark: As EMC tests may only be performed with tilted position with greater test load, there is a risk that the cause of a failed test is not known (i.e., either the weighing device or the tilt compensation device).

- **Test of behavior of tilt compensation device in dynamic mode**

A test of behavior of tilt compensation device in dynamic mode shall be performed in the following conditions:

- with 3 test loads, i.e. near Min, near Max and with a load near to but lower than 500 e
- with an amplitude of the dynamic tilt of 25 % or the limiting value once in transversal direction and once in longitudinal direction
- with a frequency between 0,03 Hz and 0,3 Hz.

- **Tare weighing test in dynamic mode**

A tare weighing test shall be performed during g-test in dynamic mode with a tare value close to 1/3 of Max with tests loads of [Max-T] and if applicable with tests loads of [500 e – T].

- **Additional examination and testing for EU declaration of type conformity or for EU verification shall be:**

- correct operation of the tilt sensor at different tilt angles but only one tilting direction
- In case of tilt switch which inhibit the indication and printing of weighing results it should be checked inhibition of displaying and printing weighing results when the maximum degree of tilting is exceeded. The same may be applicable to instruments using a tilt sensor if the indicator uses the signal of the sensor not only to compensate errors but also to decide whether the maximum tilting is exceeded and thus the displayed weight value has to be blanked out.
- tilt test like in EN 45501:2015 A.5.1.3 or if available as described within the type examination certificate
- dynamic test with acceleration close to - 3 m/s² and to + 3 m/s² with test load close to Max with appropriate frequency (≤ 0,3 Hz).
- In service control and periodical verification shall be dealt with nationally.

2.3.2 Vehicle mounted instruments

Vehicle mounted instruments present some problems to pay attention to.

EN 45501 requires that a NAWI must be verified by means of weights. On some vehicle mounted instruments it is difficult to put weights, further with the use of weights the center of gravity is not the same as with the product.

Notified bodies shall pay attention when establishing a TEC for vehicle mounted instruments that means shall be foreseen to apply weights on the load receptor and that a verification method is described in the handbook.

2.3.3 General requirements

2.3.3.1 Class I instruments – restrictions on use

Clause 4.1.2.4 of EN 45501:2015 states that: “On a class I instrument, devices to adjust sensitivity (or span) may remain unsecured.”

It is accepted that such an instrument complies with the essential requirements, but that a restriction on the use of such instruments for certain applications, e.g., commercial transactions, can be handled in national legislation.

2.3.3.2 Class I instruments; $d < 0,1$ mg

For Class I instruments where $d < 0.1$ mg the instrument need not be marked with differentiated digits where the instruments are used for an Article 1.2(a) application other than indent 1 or indent 6 1.2(a) and 1.2(f). The limitation should be included in the EU type examination certificate.

2.3.3.3 Accidental repetition of a weighed item

Some form of interlock is necessary to prevent the accidental repetition of a weighed item. Although the detection of weight disturbance is the ideal form of interlock, any

alternative method, such as the necessity of re-entering the Price Look Up (PLU) code, may be acceptable but must be stated in the type examination certificate.

2.3.3.4 Sealing arrangements – footprints

Directive 2014/31/EU states that “components that may not be dismantled or adjusted by the user shall be secured against such actions.” Tamper resistant screws are not, on their own, sufficient, as the breaking of a seal should leave a “footprint”.

2.3.3.5 Securing of load receptors by unambiguous identification

In such cases the security against dismantling is to provide non-removable labels on both the load receptor and the indicator having a common serial number or cross reference between the indicator and load receptor that identifies the verified combination that must be used. The deliberate opening of a connector to insert components, or the cutting of a cable, could be considered as fraud, and that no special protection against it was needed.

2.3.3.6 Immunity of interfaces: EN 45501, Section 5.3.6.1

No physical test procedure is available to verify compliance with the requirements of Section 5.3.6.1.

Therefore a specific declaration of the manufacturer is considered sufficient.

2.3.3.7 Electrical testing and high resolution mode

During the disturbance tests, it is the performance of the instrument in normal operating mode that is usually the main concern. If possible, therefore, any special high-resolution mode ($d < e$) should be switched off for these tests.

However, when testing an indicator, it may be advantageous to perform these tests in high resolution mode.

2.3.3.8 Significant fault detection

As this is purely optional, the documentation should contain information about the form of the reaction to the detection of a fault. Confusion with other error messages, display blanking etc. should be avoided.

No tests to trigger these reactions are intended.

2.3.3.9 Securing of access to service functions via menu

Service functions which may be used to modify metrological parameters or the adjustment of the instrument must be secured, for example by a dip switch which is secured, and may not be accessible by password unless it automatically becomes evident that a change has taken place (eg automatically displaying a new code number on switch on after each change has taken place which can be compared with a durably marked code number on the data plate representing the last set-up).

2.3.3.10 EMC Report lacking measuring instrument results

An EMC Test Report issued by an accredited laboratory and submitted to a Notified Body for consideration in its examination of an instrument, should include test values, and not simply conclusions. For example, it is not sufficient for the report simply to state that the test was passed, or that the difference between the indications with and without the disturbance did not exceed e .

The scope of the accreditation must include EN 45501 and/or R 76.

It is recommended that Test Reports follow the format of R 76-2.

2.3.3.11 Vehicle weighing by summation of individual wheel load NAWIs (“axle weighers”)

If the total weight of a vehicle is calculated automatically by summing the individual weight values produced by individual wheel load NAWIs (“axle weighers”), the system is not to be regarded as being one single NAWI. The mpe does not apply to calculated weight.

(See also 2.3.4.6)

2.3.3.12 Meaning of “identical load cells”

WG2 decided that individual load cells in an instrument may be replaced by load cells that are identical but with the same or a better accuracy class. Load cells, identical except for their accuracy class, may be used together. In that case in the calculation of compatibility the accuracy class of the cell with the lowest accuracy class must be taken.

2.3.4 Indication of weighing results and other weight values

2.3.4.1 Indication of unstable equilibrium

The use of a flashing unit sign, as an indication that the equilibrium is unstable, is only considered acceptable on instruments not intended for direct selling to the public, and then preferably only on instruments for laboratory use.

2.3.4.2 Use of slashed zeros

The use of slashed zeros is generally acceptable so long as the presentation is unambiguous.

2.3.4.3 Multiple range NAWI automatic changeover at $\text{Max}_i + 9e$

This interpretation is not valid for new instruments because it is in conflict with the standard EN 45501, clause 4.2.3.

On a multiple range NAWI, EN 45501 Section 4.10 allows automatic changeover “from a smaller to a greater weighing range when the load exceeds the maximum gross weight of the range being operative” (Max_i).

However, EN 45501 Section 4.2.3 states that “there shall be no indication above $\text{Max} + 9e$ ”, obviously allowing indications up to $9e$ above Max .

Although it is preferable for a multiple range NAWI with automatic changeover to change from a smaller to a greater weighing range when the load exceeds Max_i , it is acceptable for it to change at $\text{Max}_i + 9e$ (or any intermediate value) if this is clearly stated in the Type examination certificate.

2.3.4.4 Concealed primary indications

On some equipment, for example some incubators having a weighing function, the primary indication of weight is concealed within the housing and is therefore not normally visible.

Although it is obviously preferable for the primary indication to be visible in normal use, it is acceptable for it to be hidden if there is easy access to it.

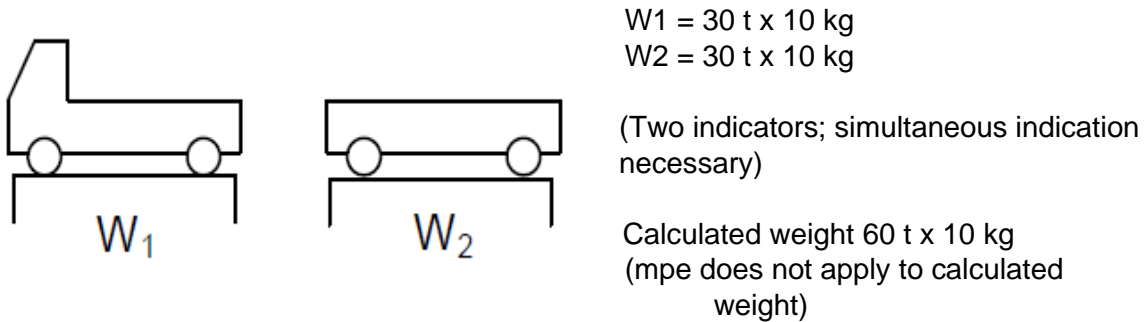
2.3.4.5 Self Service Weighbridges

WG2 decided that on self-service Weighbridges the user must know whether the instrument indicates zero or not. If considered necessary, the printout could identify that the result has been gathered by a self-service weighbridge. It shall be taken care that the vehicle is correctly positioned on the load receptor and that the operating station is accessible from the vehicle.

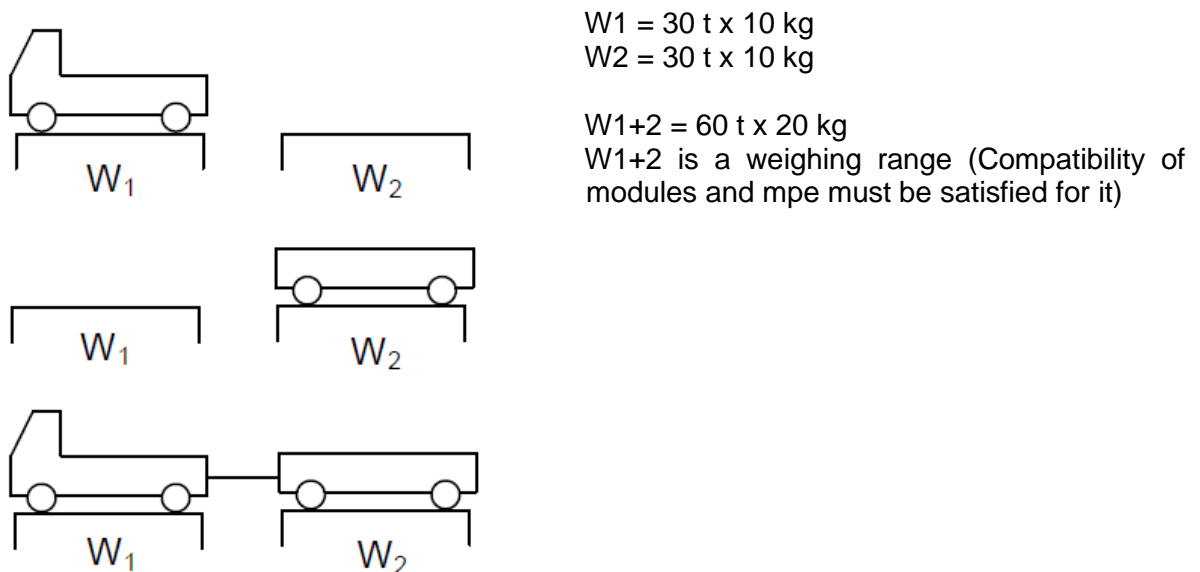
2.3.4.6 Weight obtained by using adjacent weighbridges

This concerns weight obtained by using adjacent weighbridges. Acceptable solutions, with examples, are shown below:

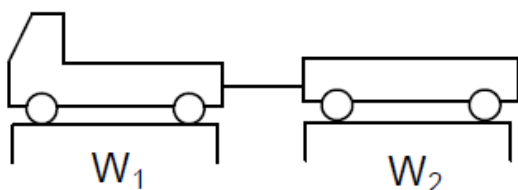
- **Two weighbridges, each with its own indicator:**



- **Multi-plate weighbridge with one indicator:**



The configuration of two weighbridges, each with its own indicator is not considered to be acceptable when used in the following manner:



2.3.5 Printing of weighing results and other weight values

With respect to printing under Min for instrument for direct sales to the public see the guidance given at 2.3.10

2.3.5.1 Weight barcodes

In relation to NAWIs which produce weight barcodes, this must always be in addition to the normal printout of the weight. Only when a POS forms part of a NAWI and manually entered weights (either hand entered or by barcode entry) are accepted must the customer's receipt clearly distinguish those entries from actual weighed entries.

2.3.5.2 Auxiliary indicating devices (ct).

The Directive 2014/31/EU, Annex I specifies in 2.2.3:

For instruments with auxiliary indicating devices the following conditions apply:

$$e = 1 \times 10^k \text{ g,}$$

$$d < e \leq 10 d,$$

except for instruments of class I with $d < 10^{-4} \text{ g}$, for which $e = 10^{-3} \text{ g}$.

For the metric carat the following is acceptable:

$$e = 1 \times 10^{k+1} \text{ ct,}$$

$$d < e \leq 10 d,$$

except for instruments of class I with $d < 10^{-3} \text{ ct}$, for which $e = 10^{-2} \text{ ct}$.

For instruments that are able to display in both units if the Max, Min and e values are on a label then they must be marked on the instrument in both units. If the values are shown on a display then they can be switched.

2.3.6 Levelling

2.3.6.1 Tilt testing of vehicle mounted NAWI

No guidance.

2.3.7 Zeroing

2.3.7.1 Point of Sale (POS) devices - indication of Zero between two operations

It is not necessary for a Non-automatic Weighing Instruments (NAWI) connected to a Point of Sale (POS) device to indicate "0" between two (consecutive) operations.

2.3.8 Tare devices and preset tare devices

2.3.8.1 Preset tare

The EN 45501:2015 reads in the first paragraph of 4.13.4: A preset tare device may be provided if the preset tare value is indicated as a primary indication on a separate display which is clearly differentiated from the weight display.

It is not acceptable to indicate preset tare values on weighing instruments for direct sales to the public without having a separate display, even when the primary indications are shown long enough for the customer to read them properly or when all primary indications are printed clearly, unambiguously and conveniently arranged on a ticket or label for the customer.

This would be confusing to customers and would therefore not meet Essential Requirement 14 of Annex 1 of the NAWI Directive.

2.3.8.2 NAWI – Question about Preset Tare – Is a “cumulative mode” allowed?

Example: five small boxes and five large boxes are weighed together on a pallet. The operator uses the “Tare Look Up” facility to tare off the small boxes and then the large boxes, and finally the pallet, to determine the net weight of goods in the boxes. This is not intended for direct sales to the public.

WG2 concluded that this concept is unacceptable. Cumulative rounding errors with the several preset tares could easily result in large errors in the net weight

2.3.8.3 Variable tare

This case treats the case of entering a tare as a percentage value of the determined (gross) weight.

Example: the user of the weighing instrument knows about a percentage of water which a fish can pick up (during production process). This relative tare value is then laid down in the PLU of the fish. In addition a preset tare value for the packaging is entered.

WG2 decided that the printed Net weight must be the effective Net weight of the product. The weight value cannot be modified by a calculation. For market surveillance reasons it must be possible to repeat the measurement and to compare the declared weight with the effective weight.

Next to the information required by the Directive 2014/31/EU Annex I No 14 a calculated price, a reduction due to the accumulated water in the product, can be added

2.3.9 Instruments for direct sales to the public, with a maximum capacity not greater than 100 kg: additional requirements.

With respect to printing under Min see the guidance given at 2.3.10.

2.3.9.1 Display of preset tare for direct sales to the public

The EN 45501:2015 reads in the first paragraph of 4.13.4: ‘A preset tare device may be provided if the preset tare value is indicated as a primary indication either on a separate zone of the display, or on a separate display. However it must be clearly differentiated from the weight display.’

It is not acceptable to indicate preset tare values on weighing instruments for direct sales to the public without having either a dedicated zone on the display or a separate display, even when the primary indications are shown long enough for the customer to read them properly or when all primary indications are printed clearly, unambiguously and conveniently arranged on a ticket or label for the customer.

This would be confusing to customers and would therefore not meet Essential Requirement 14 of Annex 1 of the NAWI Directive.

2.3.9.2 Retail NAWI or POS with totalisation - requirement for printer

Directive 2014/31/EU states, in its Annex 1, Clause 14:

Instruments used for direct sales to the public with a maximum capacity not greater than 100 kg: additional requirements.

Price computing instruments may perform functions other than per-article weighing and price computation only if all indications related to all transactions are printed clearly, unambiguously and conveniently arranged on a ticket or label for the customer.

Therefore, a price computing NAWI (or POS) used for direct sales to the public which may also perform functions other than per-article weighing and price computation, for example totalisation, must produce a printout for the customer. Section 14 of the Essential Requirements (Annex 1) of the NAWI Directive is relevant.

If the printer is unable to print out the data relating to the totalising, then the totalising feature should be inhibited.

Further clarification on this subject is provided below:

- According to clause 14, 4th paragraph, of directive 2014/31/EU printing is mandatory for price-computing instruments (for direct sales) that may perform functions other than per article weighing and price computation.
- The initialisation of the (mandatory) printing step can either:
 - be triggered automatically by the weighing sequence, or
 - the weighing sequence can stop before printing and wait for a manual command to print, or
 - the print-out of all weighed items and non-weighed items can be performed at the end of the transaction. A new transaction can only commence after the print-out has been completed. Note: the printing step can't be circumvented and must be completed, either after each weighing sequence or at the end of the transaction.
- 'Printing' on a secondary screen or in the same screen does not fulfil the requirements because this is not "printing" (it is "displaying") and so does not achieve the objective of letting the customer review if the items and price listed are those that have been purchased.
- When a POS is connected to a NAWI the requirement for mandatory printing must also be fulfilled by the POS.

2.3.9.3 Retail NAWI installed in a fixed position in a checkout

A retail flush-mounted NAWI simply sitting in a well in a checkout surface without being bolted in position can be regarded as being "installed in a fixed position" (as in Section 3.9.1 of EN 45501). This is commonly done so that it can temporarily be lifted out for cleaning.

As it is regarded as being "installed in a fixed position", it does not need to have a level indicator. However, if it does not have a level indicator it should then be verified in its fixed position in the checkout, unless the verifier (or manufacturer if declaring conformity) has a suitable procedure to ensure that verification elsewhere will result in the requirements being met when it is installed into the well.

If the manufacturer chooses not to have a level indicator, then the manufacturer must take responsibility for the instrument being installed correctly unless it has been tested and approved to an angle of 5 %.

For an instrument without a level indicator, intended to be “installed in a fixed position”, there is no requirement for tilt testing during type examination. For an instrument having a level indicator, EN 45501 Section 3.9.1.1 requires that the level indicator be in a place clearly visible to the user. However, there is no such requirement in the NAWI Directive, and it is therefore acceptable for the level indicator on any NAWI to be fitted in a place where it is easily accessible but not normally visible, for example, beneath the load receptor if that can easily be removed.

2.3.10 Price labelling instruments

Point 15 of the Annex I of the NAWI-directive 2014/31/EU states the following:

“Price labelling instruments shall meet the requirements of price indicating instruments for direct sale to the public, as far as applicable to the instrument in question. The printing of a price label shall be impossible below a minimum capacity”.

According to Annex I of the NAWI-directive the terminology used in annex I of the NAWI-directive is that of the International Organization of Legal Metrology.

According to EN 45501:2015 the definition of a Price-labeling instrument (T 1.2.9) is:

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

Therefore, the essential requirement in point 15 of annex I is only applicable to non-automatic weighing instruments that print the weight value, unit price and price to pay for prepackages.

This essential requirement is not applicable to other non-automatic weighing instruments, in particular price-computing instruments used for direct sales to the public.

Related with this is the suitability for use which is typically covered by National Law. Suitability of use is typically interpreted so that a non-automatic weighing instrument should not regularly be used under Min, weighing under Min should be an exception.

3 Annex III: Inscriptions

3.1 Instruments intended to be used for the applications listed in points (a) to (f) of Article 1(2)

3.1.1 Max, Min, e and d, and other markings/inscriptions

Where the inscriptions Max, Min, e and d are provided near to, or on, the display, it is not necessary for them to be additionally marked on the data plate. (Although EN 45501, in its Section 7.1.3, appears to require that all the descriptive markings be grouped together, Annex III of the Directive 2014/31/EU solely requires the CE marking and the ID number of the Notified Body to be grouped together.)

In the following table, the different types of “presentation” are as follows:

A = Data must be presented on a data plate or on the instrument itself (i.e., by hardware)

B = Data may be presented either on a data plate (i.e., by hardware) or in the display (i.e., by software). In the latter case the data must be permanently displayed, but it is

acceptable for the Max, Min, e (and d if appropriate) to be permanently displayed scrolling sequentially.

C = Data may be presented either on a data plate (i.e., by hardware) or in the display (i.e., by software). In the latter case the data may be displayed on request of the user.

Marking / Inscription	2014/31/EU, Annex III	Presentation
CE conformity marking	1.2	A
Year of affixing the CE marking		A
Identification No of Notified Body		A
Type Examination Certificate No	1.1	A
Manufacturer's mark or name		A
Accuracy class		B
Serial number		C
Scale interval d, if $d \neq e$		C
Max. tare effect T (additive, subtractive)		C
Max. safe load <i>Lim</i> (if $\neq Max$)		A
Special temperature limits		B
<i>Max, Min, e, (d)</i> near display	1.4	B

Software containing these markings/inscriptions must be secured from unauthorised access or changes. Details of the markings/inscriptions contained in software must be declared in the TEC.

3.1.2 Marking of range of tare device

If the maximum subtractive tare effect is equal to Max or is equal to the actual range of indication (which may be up to $Max + 9e$), then it need not be mentioned on the descriptive plate.

3.1.3 Access to data plate and markings

Some NAWIs have their data plates hidden from view. For example, many that are flush mounted into checkout surfaces have their data plate hidden below the load receptor, it being difficult or impossible to locate it anywhere else.

This is actually a non-conformity according to the NAWI Directive, and although it is readily accepted in some countries if the position of the data plate is shown in the examination certificate, manufacturers should be aware that it might not be acceptable in other countries.

3.2 Instruments not intended to be used for the applications listed in points (a) to (f) of Article 1(2)

3.2.1 Declaration of Conformity and 1.2(g) application

A manufacturer who provides a Declaration of Conformity acc. to 2014/31/EU for an instrument which can only be used for a 1.2(g) application is implying that the instrument meets the technical requirements leading to the application of the CE marking. This is misleading and incorrect, and contrary to the provisions of the Directive.

3.3 EU DECLARATION OF CONFORMITY

The clause 7.2 of the annex II of the directive 2014/31/EU authorizes a conformity assessment according to modules D, D1, F, F1 or G in two stages if the instrument's performance is sensitive to gravity variations. This is a two-stage EU declaration of

conformity procedure where the validity of the declaration of conformity depends on evidence (signature) of the carrying out of the second stage of the procedure.

EU Declaration of conformity

1. Instrument model/instrument

The non-automatic weighing instrument(s)

Type/Model:	
No of the EU Type Examination Certificate (where applicable):	
Serial number(s):	

2. Name and address of manufacturer and, where applicable, his authorised representative:

3. This declaration of conformity is issued under the sole responsibility of the manufacturer

4. Object of the declaration (identification of instrument allowing traceability; it may, where necessary for the identification of the instrument, include an image):

5. The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

6. References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared

7. Performed examinations and tests referred to in EN 45501 - 8.2 on 1st stage, with the exception of the following tests:

Signature	Date
-----------	------

Tests completed on 2nd stage:

Utilised g: m/s²

Signature	Date
-----------	------

Section B - Decisions of common application for 2014/32/EU (Measuring Instruments Directive)

The following is a list of decisions reached by WELMEC Working Group 2 (WG2) of common application under Directive 2014/32/EU, in respect to the following:

- Annex I, Essential Requirements
- Annex VIII, Chapters I to VI, Automatic Weighing Instruments (MI-006)
- Annex XI, Chapters I and IV, Multi-Dimensional Measuring Instruments (MI-009)

4 Annex I: Essential Requirements

4.1 Allowable errors

No guidance.

4.2 Reproducibility

No guidance.

4.3 Repeatability

No guidance.

4.4 Discrimination and sensitivity

No guidance.

4.5 Durability

No guidance.

4.6 Reliability

No guidance.

4.7 Suitability

No guidance.

4.8 Protection against corruption

No guidance.

4.9 Information to be borne by and to accompany the instrument

No guidance.

4.10 Indication of result

No guidance.

4.11 Further processing of data to conclude the trading transaction

No guidance.

4.12 Conformity examination

No guidance.

5 Annex VIII: Automatic Weighing Instruments (MI-006)

5.1 Definitions

When classifying an automatic weighing instrument as either an automatic Catchweigher or an automatic gravimetric filling instrument, it is important to determine if the instrument prints or stores an actual weight or if it fills to a predetermined load.

Where the instrument in question prints or stores an actual weight to be used for a regulated use (for example commercial transactions) then it is an automatic catchweigher (weight labeler). Alternatively, the actual weights could be printed or stored for management purposes only, in which case the instrument would be a filling instrument provided that the bag/pack that is filled is marked with the nominal (predetermined) weight and not the actual weight.

Clarification from discussion at Meeting 38:

- Definitions from 2014/32/EU:
 - Automatic catchweigher: „An automatic weighing instrument that determines the mass of pre-assembled discrete loads (for example prepackages) or single loads of loose material”
 - Automatic checkweigher: “An automatic catchweigher that subdivides articles of different mass into two or more subgroups according to the value of the difference of their mass and a nominal set- point.”
 - Automatic gravimetric filling instrument: „An automatic weighing instrument that fills containers with a predetermined and virtually constant mass of product from bulk.”
- Additional information for Automatic gravimetric filling instruments from:
 - OIML R61-1, edition 2004 (superseded in 2017, see below), No. 3.3.3, 3rd paragraph: “Any printout is for information purposes only and not for use in any commercial transaction, except preset values and number of weighing’s.”
 - This is no longer included in OIML R61-1, edition 2017.

5.2 Chapter I – Requirements common to all types of automatic weighing instruments

5.2.1 Rated operating conditions

No guidance.

5.2.2 Permissible effects of disturbances – Electromagnetic environment

No guidance.

5.2.3 Suitability

No guidance.

5.2.4 Conformity assessment

No guidance.

5.3 Chapter II – Automatic catchweighers

5.3.1 Accuracy classes

No guidance.

5.3.2 Category X instruments

No guidance.

5.3.3 Category Y instruments

No guidance.

5.3.4 MPE

No guidance.

5.3.5 Measurement range

No guidance.

5.3.6 Dynamic setting

No guidance.

5.3.7 Performance under influence factor and electromagnetic disturbance

No guidance.

5.4 Chapter III – Automatic Gravimetric Filling Instruments

5.4.1 Accuracy classes

No guidance.

5.4.2 MPE

No guidance.

5.4.3 Performance under influence factor and electromagnetic disturbance

No guidance.

5.5 Chapter IV – Discontinuous Totalisers

5.5.1 Accuracy classes

No guidance.

5.5.2 MPE

No guidance.

5.5.3 Totalisation scale interval

No guidance.

5.5.4 Minimum totalised load (Σ_{\min})

No guidance.

5.5.5 Zero setting

No guidance.

5.5.6 Operator interface

No guidance.

5.5.7 Printout

No guidance.

5.5.8 Performance under influence factor and electromagnetic disturbance

No guidance.

5.6 Chapter V – Continuous Totalisers

5.6.1 Accuracy classes

No guidance.

5.6.2 Measurement range

No guidance.

5.6.3 MPE

No guidance.

5.6.4 Speed of belt

No guidance.

5.6.5 General totalisation device

No guidance.

5.6.6 Performance under influence factor and electromagnetic disturbance

No guidance.

5.7 Chapter VI – Automatic Rail Weighbridges

5.7.1 Accuracy classes

No guidance.

5.7.2 MPE

No guidance.

5.7.3 Scale interval (d)

No guidance.

5.7.4 Measurement range

No guidance.

5.7.5 Performance under influence factor and electromagnetic disturbance

No guidance.

6 Annex XI: Multi-dimensional Measuring Instruments (MI-009)

6.1 Chapter I – Requirements common to all dimensional measuring instruments

6.1.1 Electromagnetic immunity

No guidance.

6.2 Chapter IV – Multidimensional measuring instruments

6.2.1 Operating conditions

No guidance.

6.2.2 MPE

No guidance.

Section C - Revisions of this guide

Issue	Date	Significant changes from previous issue
8	September 2022	Total revision of the guide. Implementing the directives: 2014/31/EU and 2014/32/EU
		Implementing all regulations from previous Guide Versions

Annex 1 of WELMEC Guide 2 - sections from previous versions of the Guide that have been removed and will be included in WELMEC Guide 2.10

Load cells

(Note that throughout this guide, “load cells” refers to analogue load cells rather than digital load cells unless stated +otherwise.)

Barometric pressure tests for load cells

Where a load cell design makes it unnecessary to test for the effect of barometric pressure, the test may be declared not applicable, and the test certificate shall state the reason for not testing.

R 60 Certificates of Conformity

Section 1 of Clause A.5 of WELMEC 2.4 is interpreted to mean that, for the modular approach, only R60 Certificates issued by a Notified Body responsible for type examination under Directive 2014/31/EU are acceptable, despite mutual recognition agreements having been made by some Notified Bodies with organisations outside the WELMEC area.

Minimum output dead load return (multi-interval or multiple range)

The requirement of Annex F of EN 45501 is relaxed for multi-interval and multiple range instruments by applying the following formula for minimum dead load output return:

$$Z = \frac{E_{max}}{2 DR} \geq \begin{array}{ll} \text{either} & \frac{\max_r}{e_1} \quad \text{for multi-interval} \\ \text{instruments} & \\ \text{or} & 0.4 \frac{\max_r}{e_1} \quad \text{for multiple range} \\ \text{instruments} & \end{array}$$

Where:

- Z = ratio to minimum load cell dead load output return:
- E_{max} = maximum capacity of the load cell
- DR = minimum dead load output return
- \max_r = maximum capacity of the weighing instrument
- e = verification scale interval

Hermetically sealed load cells

All load cells that are marked “NH” must undergo humidity testing, regardless of whether or not they are believed to be “hermetically sealed.”

Load cell inaccessible at verification

With many NAWIs, it is not possible to check that the correct load cell has been fitted without partially dismantling the NAWI.

For EU-verification the manufacturer declares conformity and the verifier tests. There is therefore no need for the verifier to inspect the load cell.

Periodic verification or market surveillance comes under national legislation, and conformity to type might, or might not, be covered. The instrument can be opened if there is a suspicion that the incorrect load cell is fitted.

Securing of load cell junction boxes

Analogue load cell junction boxes shall be secured, and details of the securing shall appear in the Type examination Certificate.

Digital load cell junction boxes shall be secured if necessary.

Load cell cable length

If a junction box is used, then the load cell cable is defined as the cable from the load cell itself to the junction box, and the indicator is considered to include the cable from the indicator to the junction box.

The temperature compensation circuitry of the load cell is matched to the standard length of cable with which the load cell is manufactured. Where the load cell utilises a 4-wire cable the cable should not be cut, extended or modified, as the temperature compensation may then no longer be correct. A statement to this effect should be included in the Test, Part or Evaluation Certificate (TC) for the load cell.

This guidance does not apply to digital load cells, or to 6-wire load cells used with an appropriate indicator.

Load cell cable connected to indicator by plug and socket

Section 8.5 of Annex I of Directive 2014/31/EU requires that components that may not be dismantled or adjusted by the user shall be secured against such actions.

In the case of a load receptor where

- the user does not have access to the load cell cables (realised e.g., by a sealed junction box), and
- where the output cable connects to the (sealed) indicator by means of a plug and socket arrangement,

Security of the connection is normally considered to be reached if tamper-evident labels are provided on both the load receptor and the indicator having a common serial number or cross reference between the indicator and load receptor that identifies the verified combination that must be used.

The TEC may contain alternative provisions to ensure continued integrity of the combination (e.g., Mechanically coded plugs, identification chip that can be polled, or special sealing provisions).

WELMEC Guide 2.4, A.3 – Meaning of “identical load cells”

WELMEC Guide 2.4 Annex A.3, dot 3 mentions “identical” load cells. That could lead to the assumption that they have to be of the same accuracy class.

WG2 decided that individual load cells in an instrument may be replaced by load cells that are identical but with the same or a better accuracy class. Load cells, identical except for their accuracy class, may be used together. In that case in the calculation of compatibility the accuracy class of the cell with the lowest accuracy class must be taken.

Identification of software stored on EPROM

For a complete instrument:

- conformity to type is now covered by the declaration of conformity from the manufacturer,

- there is no danger of access by the user to software on EPROM,
- there is no obligation for software identification on EPROM for a complete instrument.

Concerning modules however, there is no declaration of conformity procedure. Therefore, where Test Certificates (TCs) are involved, there is a need for the identification of software stored on EPROM. Refer to the “Identification of software on EPROM” section of the WELMEC 2.5 guide.

Annex 2 of WELMEC Guide 2 - sections from previous versions of the Guide that have been removed with the condition that WG7 needs to be informed of this removal

Software securing (sealing)

The term "software securing" (sometimes also called "software sealing") is often used in different connections. In order to avoid misunderstandings, it is stated that in the following it is exclusively used in the sense of Directive 2014/31/EU, Annex I, No 8.5, and EN 45501, No 4.1.2.4, respectively, thus meaning provisions for securing components and pre-set controls to which access or adjustment is prohibited.

In order to harmonise EU type examination certificates with regard to software securing methods which, completely or partially, replace conventional "hardware" securing measures (e.g., wire and lead, or control marks), the following principles and guidelines are proposed:

Legal status of the instrument

By analogy with conventional sealing methods, the legal status of the instrument must be recognisable to the user or any other person responsible at the instrument itself.

Examples of acceptable technical solutions:

- a. An event counter, i.e., a non-resettable¹⁾ counter, that increments each time a protected operational mode of the instrument is entered, and one or more changes are made to device-specific parameters (see also WELMEC 2.3 guide). The reference number of the counter at the time of (initial or subsequent) verification is fixed and secured by appropriate hardware means at the instrument itself.

¹⁾ The term "non resettable" implies that if the counter has reached its maximum number, it will not continue to zero without the intervention of an authorised person.

or

- b. An event logger, i.e., a file containing a series of records where each record contains at least the number from the event counter and the date corresponding to the change of a device specific parameter (see also WELMEC 2.3). Optionally, further information may be recorded, e.g., the identification of the parameter that was changed and the new value of the parameter. The reference number of the counter or the date at the time of (initial or subsequent) verification is fixed and secured by appropriate hardware means at the instrument itself.

Note:

The indication that an unauthorised change of protected device specific parameters has happened need not necessarily be shown on or near the instrument's display. The latter method may, however, be chosen as an additional option. It is sufficient if the weighing instrument can, by a simple procedure, present the relevant actual data for comparison with the reference data recorded at the last verification in order to inform the user or any other person responsible about the legal status of the instrument. **Details have to be described in the operating manual, and in either the Type Examination Certificate of the instrument or the Test, Part or Evaluation Certificate of its module (indicator).**

Protection of software securing

Software securing methods must guarantee a sufficient protection and long-term storage of the data registered.

The following protection measures are considered to be adequate for event counters and event loggers:

- All entries (the counter number in case of an event counter or the data registered by an event logger) must be protected against intentional and unintentional changes in the sense of WELMEC 2.3. It is guaranteed by appropriate means that the event counter (event logger) automatically increments (registers) each time a protected operational mode of the instrument is entered, and a device specific parameter is changed, and there is no possibility to fraudulently change the counter (registered data) in either mode, and
- the hardware medium used for storing these data must be protected against unauthorised replacement, or an unauthorised replacement is obvious or can be made evident by appropriate means.

Example of an acceptable technical solution:

The chip for storing the event counter (event logger) data is soldered onto the circuit board inside the instrument and the board itself is protected against unauthorised exchange.

Note:

As a rule, the hard disk of a PC is not considered to provide sufficient protection of event counter or event logger data.

Reference data for software securing

An instrument making use of a software securing method shall have adequate facilities either for affixing of the reference data on or near the main plate by an authorised person or body, or for showing this data on the instrument's display on demand.

The following then apply:

Reference data on or near the main plate

Examples of acceptable technical solutions:

- a. Inscription of the reference number (data) on or near the main plate in accordance with Directive 2009/23/EC, Annex IV, 1.2.
- b. Adjustable (hardware) counter that is firmly mounted to the instrument and that can be secured after it has been adjusted to the actual counter number at the time of (initial or subsequent) verification.

Reference data displayed

Where this displayed data can be altered by means of software access, the instrument must have adequate facilities within a protected log to hold, at least, the following data: Relevant reference data and changes, date and time of intervention, identity of authorised person or body.

This data must be saved in the instrument for a period of time commensurate with the requirements of the member state. The identity of the authorised person or body must be guaranteed.

Annex 3 of WELMEC Guide 2 - sections from previous versions of the Guide that have been removed with the condition that WG8 needs to be informed of this removal

Criteria or additions to the EC type examination Modifications

The requirements relating to modifications to the approved type are set out in 1.7 of Annex II to the Directive. The Directive requires the applicant to keep the Notified Body who issued the type examination certificate informed of any modification to the approved type.

Modifications without addition to the EC type examination certificate

Not all modifications to the approved type will require an addition to the EU type examination certificate.

Replacement of a part, device or sub-assembly

The opinion expressed by the Working Group in general terms is that any replacement of a part, device or sub-assembly etc. which has a function in the measurement path must receive additional examination i.e., load receptor to display and printout.

Where that replacement is of an analogue part this must be tested in addition to receiving examination e.g., load cells, analogue PCBs (including A/D1 convertors). Test results previously obtained will be taken into account.

Unauthorised translations of EU type examination certificates

It is the responsibility of the manufacturer to make the EU Type Examination Certificate available in the language necessary to enable EU verification to take place. The manufacturer may make unauthorized translations; however, the official version remains the version produced by the Notified Body which granted the EU type examination. All translations should use the terminology specified in EN 45501. Refer also to the language markings in Section 9.

Verification marks

Indicator with “green M”

An indicator should only bear a “green M” if it is part of a verified weighing system. An indicator sold on its own should not therefore bear a “green M” and neither should an indicator being used only for non-trade purposes.

Visibility of CE marking

CE marking addresses the market surveillance bodies of the member states and aims at facilitating their surveillance tasks by visibly demonstrating conformity. Visibility means that the CE marking is easily accessible for the market surveillance authorities. In exceptional circumstances due to the installation and manner of use of an instrument, this could mean that the CE marking is located on the instrument in a place accessible to the surveillance authorities and that its position is indicated clearly in the TEC.

Currency symbols

The currency symbols to be used on weighing instruments are of the form normally used for trade. Examples are shown in the informative document “Indication of Currency

Units". The three letter currency codes commonly used in currency exchange transactions are not acceptable for this purpose in some countries.

EU-type examination certificate - validity date and prolongation

In relation to the validity date of an EU Type Examination Certificate (normally 10 years from date of examination), this original date should remain the validity date even when any additions to, or revisions of, the TEC are issued.

When an application is made to the Notified Body for the prolongation (renewal) of a TEC, it is possible that the guidance given by WELMEC in its guides may have changed since the TEC was issued. Nevertheless, an instrument that complied with Directive 2014/31/EU when the TEC was issued, must still be regarded as complying, regardless of any subsequent WELMEC guidance. Note that for any requirement of the Directive itself that has changed, for example as in the use of Imperial units of weight (see Section 3.1.19), the instrument must comply with the present requirement.

However, as the intention of the ten-year limit on NAWI examinations was to ensure a reassessment after that time, the Notified Body performing the renewal of the certificate needs to re assess the instrument, although it is possible that this might only be a paperwork exercise.

There is no need for the Notified Body to ensure that the instrument still complies with the original technical documents, as the manufacturer has to declare conformity to the examination for every instrument brought into use. If any modifications to the instrument have been made, then these should have been approved under the existing certificate. The form of the renewal varies between Notified Bodies. For example, it might be a single sheet extending the validity of the certificate, or the entire certificate might be issued with the new validity date, or a new certificate might be issued referring to the old certificate number. Regardless of which method is used, it is essential that all the information remains available.

Marking of Test, Part or Evaluation Certificate number on module or peripheral

The marking of the Test, Part or Evaluation Certificate number on a module or peripheral is mandatory.

Note: This is not applicable if the module or peripheral is described in the weighing instrument's Type examination certificate.

Declaration of Conformity - manufacturer's responsibility

Under the New Approach Directives such as 2009/23/EC, it is the manufacturer who draws up the Declaration of Conformity and not the Notified Body. The Declaration of Conformity is for production control and not for verification or examination.

Although, obviously, the Declaration of Conformity must relate to the type of instrument concerned, it is not necessary for it to reflect the actual type covered by revisions or additions to the Type Examination Certificate, as it might not be practical to update the Declaration of Conformity after every revision or addition.

The manufacturer may affix the CE mark, year and green M before the conformity assessment has been done, as these markings only become valid when all the conformity procedures have been completed.

The manufacturer remains responsible for completing conformity assessment.

Declaration of Conformity - compatibility documents

Each time a Type Examination Certificate is issued that takes advantage of the modular approach, the Notified Body issuing it should repeat a clear message to the manufacturer that special attention should be given to the necessary compatibility documents to be prepared.

Manufacturers need to remain aware of the responsibility they bear in this respect.

Test, Part or Evaluation Certificates for software

Test, Part or Evaluation Certificates for NAWI software may only be issued to the WELMEC 2.3 guide. Test Certificates for free programmable PC based POS modules including software may only be issued following software examination in accordance with the WELMEC 2.3 guide.

(The WELMEC 7.1 and 7.2 guides do not apply to NAWIs, and software examination to only the Essential Requirements of Directive 2014/31/EU is not considered sufficient.) Type Examination certificates for free-programmable NAWIs, or Test, Part or Evaluation Certificates for free-programmable POS hardware, must either include details of the software or must refer to specific Test, Part or Evaluation Certificates for the software. Test, Part or Evaluation Certificates for POS systems should now only be issued for the combination of hardware and software, as described in the WELMEC 2.2 guide Issue 3.

CE marking - year of affixing

Directive 2009/23/EC, amended by Directive 93/69/EEC, says that the instrument must bear the last two digits of the year in which the CE marking was affixed.

It is not acceptable for the year to be shown as four digits.

Data storage device having Evaluation Certificate or Parts/Test Certificate

For a data storage device having an Evaluation Certificate or Parts/Test Certificate, if advantage is to be taken of the modular approach of the WELMEC guides, then the following text must be in the Evaluation Certificate or Parts/Test Certificate:

“A data storage device (DSD) having a Evaluation Certificate (EC) or Parts/Test Certificate (PC/TC) may be connected to a NAWI if, at conformity assessment for putting into service for an Article 1.2(a) application, it is checked that the requirements 6.1, 6.2, 6.4, 6.5 and 6.6 of WELMEC 2.5 are met.”

This text may also be put into the EU-type examination certificate if thought necessary

End of Guide